

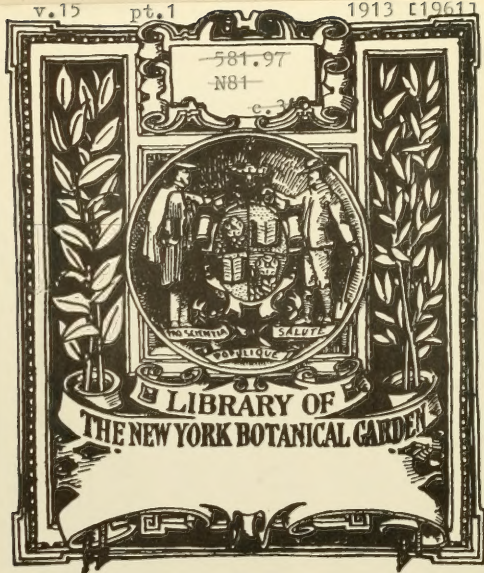
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NORTH AMERICAN FLORA

SPHAGNALES-BRYALES

SPHAGNACEAE

ALBERT LEROY ANDREWS

ANDREAEACEAE

ELIZABETH GERTRUDE BRITTON, JULIA TITUS EMERSON

ARCHIDIACEAE, BRUCHIACEAE, DITRICHACEAE, BRYOXIPHIACEAE
SELIGERiaceae

ELIZABETH GERTRUDE BRITTON



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Class MUSCI

Terrestrial, epiphytic, or rarely aquatic plants, showing two distinctly marked but closely connected and continuous phases of growth, or alternate generations:

Gametophyte usually differentiated into stem, leaves, and rhizoids (true roots none), arising from a more or less ephemeral protonema, which originates from the spore, forming either a filamentous or thallose growth. Sexual organs borne either apically or laterally on the stem, usually in special buds; antheridia and archegonia on the same plant or on separate plants. Antheridium containing ciliate sperms. Archegonium containing a single egg, after the fertilization of which the embryo develops into the sporophyte, rupturing the walls of the archegonium in its growth.

Sporophyte usually forming a seta, the base of which is imbedded in the vaginule; upper part of the archegonium, carried up by the elongation of the seta, forming the calyptra, which in most mosses covers and protects the sporogonium while it is developing. Sporogonium usually with a central axis (endothecium) forming the columella, around which the spore-sac (archesporium) is developed, usually separated from the walls (amphithecium) by air-spaces and chlorophyl-bearing tissue. Capsule dehiscent regularly by a lid or slits, or indehiscent (cleistocarpous); when dehiscent frequently developing specialized appendages around the mouth, constituting the peristome, which serves in the dissemination of the spores.

Order SPHAGNALES

By ALBERT LeROY ANDREWS

Protonema normally thalloid, the gametophyte developing from its edge; latter at first branchless, but branches soon developing, usually in fascicles of 3 or more. Archegonia borne on more or less differentiated branches; antheridia on normal or slightly differentiated ones. Epigonium rent irregularly by the ripening capsule, leaving at its base an inconspicuous sheath. Sporogonium nearly sessile, globose on a very short stalk with a bulbous base; capsule at maturity raised above the perichaetial leaves upon a prolongation of the fruiting branch (pseudopodium), dehiscent by a small apical lid; peristome none; endothecium giving rise only to the columella, upon whose broad rounded top rests the dome-shaped spore-sac. Spores tetrahedral.

(A single family:)

Fam. 1. SPHAGNACEAE.

Family 1. SPHAGNACEAE

By ALBERT LEROY ANDREWS

Characters the same as those of the order.

1. SPHAGNUM (Dill.) L. Sp. Pl. 1106. 1753.

Large erect mosses of peat-bogs, wet mountain summits, etc. Gametophyte developing apically, with rhizoids only in its initial stage; innovations through pseudo-bifurcation infrequent. Stem without a central strand, its central portion composed of thin-walled parenchymatous pith-cells, passing gradually into the thick-walled, pigmented prosenchymatous cells of the enveloping wood-cylinder, the latter mostly enclosed by one or more layers of thin-walled parenchymatous cortical cells. Branches usually in fascicles disposed spirally about the stem, near the apex densely crowded together, forming the capitulum. Leaves of the stem and branches arranged spirally, composed of a single layer of two kinds of cells: narrow linear chlorophyl-cells forming the meshes of a network enclosing the large rhomboidal hyaline cells, the latter being porose and, with the exception of one of our species, having their walls reinforced inwardly by ring-shaped or spiral fibril-bands; pores round to elliptic, often defined by a fibril-ring (ring-pores). Stem-leaves more or less differentiated in shape and size, less closely disposed than the branch-leaves, with less of pores and fibrils, but showing extensive membrane-resorption.

Plants monoicous or dioicous, the antheridial and archegonial branches always distinct. Antheridial branches single or two or three to the fascicle, the part bearing antheridia often somewhat differentiated. Antheridia long-pedicellate, globose to oval, borne each at the side of a perigonal leaf, opening at the summit when mature and releasing vesicles containing each a spermatozoid; paraphyses lacking. Archegonial branches single or rarely two together, bearing at the apex without paraphyses 1-5 archegonia, of which after fertilization only one develops into a capsule. Perichaetial leaves much larger than and usually otherwise differentiated from the other leaves, enclosing the capsule until its maturity. Mature capsule globose, dark-brown to black, with an operculum, without annulus or peristome, when empty generally contracted, urn-shaped to cylindric, brown or red-brown, its outer wall usually showing numerous pseudo-stomata. Spores tetrahedral, with a large convex face and 3 smaller plane triangular ones, 18-45 μ in longest diameter, of various shades of yellow, disseminated by explosive discharge from the capsule.

Type species, *Sphagnum palustre* L.

Cortical cells of the stem and branches reinforced by spiral fibril-bands.
(INOPHLOEA.)

Chlorophyl-cells of the branch-leaves entirely included, or exposed about equally on both surfaces.

Chlorophyl-cells of the branch-leaves short-elliptic in section, central and usually entirely included.

Chlorophyl-cells of the branch-leaves exposed about equally on both surfaces, with a central lumen.

Chlorophyl-cells of the branch-leaves usually truncately elliptic in section; papillae present.

Chlorophyl-cells of the branch-leaves narrowly rectangular to lenticular in section; papillae lacking.

Chlorophyl-cells of the branch-leaves usually triangular in section, with the base exposed on the inner surface of the leaf.

Chlorophyl-cells of the branch-leaves usually isosceles-triangular in section.

Inner walls of the hyaline cells of the branch-leaves, where overlying chlorophyl-cells, smooth.

Inner walls of the hyaline cells of the branch-leaves, where overlying chlorophyl-cells, beset with an irregular network of ridges.

Chlorophyl-cells of the branch-leaves equilateral-triangular in section.

Cortical cells of the branches with their bases plane or nearly so.

Cortical cells of the branches each communicating by a saccate to funnel-shaped extension with the next cell beneath.

1. *S. magellanicum*.

2. *S. papillosum*.

3. *S. erythrocalyx*.

4. *S. palustre*.

5. *S. henryense*.

6. *S. imbricatum*.

7. *S. portoricense*.

Cortical cells of the stem and branches without fibril-bands. (LITOPHLOEA.)

Cortical cells of the branches uniform, each with a pore at the upper end. (*Malacosphagnum*.)

Chlorophyl-cells of the branch-leaves included.

Chlorophyl-cells of the branch-leaves exposed on the outer surface.

Cortical cells of the branches of two kinds, the larger retort-cells with a neck and a pore in the axils of the leaves; or, if uniform, without pores. (*Acisphagnum*.)

Branches in fascicles of 6-12.

Branches never more than 6, rarely more than 5 to a fascicle.

Stem-leaves with the membrane of the hyaline cells mostly resorbed on the outer surface, on the inner with membrane-gaps only in the apical cells.

Chlorophyl-cells of the branch-leaves truncately elliptic in section, exposed equally on both surfaces.

Chlorophyl-cells of the branch-leaves triangular to trapezoidal in section, with broader exposure on the outer surface.

Plant large; branch-leaves ovate-hastate, mostly squarrose.

Plant smaller; branch-leaves ovate-lanceolate, usually imbricate.

Stem-leaves with the membrane of the hyaline cells usually not greatly resorbed on the outer surface, or if so, resorbed on both surfaces, producing a very lacerate leaf-apex.

Chlorophyl-cells of the branch-leaves exposed exclusively or more broadly on the outer surface; or, if with central lumen and approximately equal exposure, the pigment brown.

Stem-leaves very lacerate at the broad apex; cortical cells of the stem large, thin-walled.

Stem-leaves usually not lacerate at the apex; in case of a single rent or slight laceration, the cortical cells of the stem small, thick-walled.

Stem-leaves with a single deep rent in the middle of the apex.

Stem-leaves entire or nearly so.

Cortical cells of the stem small, thick-walled.

Hyaline cells of the branch-leaves showing on the inner surface only a few small end-pores; when stained showing numerous small round membrane-thinnings, especially on the outer surface in the lower side-regions.

Hyaline cells of the branch-leaves showing on the inner surface more numerous larger round pores in the ends and corners of cells; membrane-thinnings not apparent on staining.

Stem-leaves triangular to triangular-lingulate, their hyaline cells normally without fibrils.

Chlorophyl-cells of the branch-leaves isosceles-triangular in section, the apex of the triangle reaching the inner surface of the leaf.

Chlorophyl-cells of the branch-leaves equilateral-triangular in section, the apex of the triangle not reaching the inner surface of the leaf.

Stem-leaves oval to lingulate, their hyaline cells more or less fibrillose in the upper part of the leaf.

Cortical cells of the stem larger, thin-walled, in 1-3 layers.

Chlorophyl-cells of the branch-leaves broadly triangular in section, exposed only on the outer surface.

Chlorophyl-cells of the branch-leaves mostly exposed on both surfaces; if exposed only on the outer surface, narrowly triangular in section.

Chlorophyl-cells of the branch-leaves triangular to rhomboidal in section, with broader exposure on the outer surface, the lumen triangular.

Branch-leaves with few small pores on the outer surface, 2-5 per cell.

Branch-leaves long-lanceolate to linear-lanceolate.

Branch-leaves short-ovate to oblong or nearly quadrate.

8. *S. compactum*.

9. *S. strictum*.

10. *S. Wulfsanum*.

11. *S. Ångströmi*.

12. *S. squarrosus*.

13. *S. teres*.

14. *S. Lindbergii*.

15. *S. riparium*.

16. *S. obtusum*.

17. *S. recurvum*.

18. *S. pulchrum*.

19. *S. balticum*.

20. *S. tenellum*.

21. *S. cuspidatum*.

22. *S. Fitzgeraldi*.

- Branch-leaves with numerous pores on the outer surface, 5-20 per cell; if fewer, large.
- Pores very large, midway between the commissures. 23. *S. Dusenii*.
- Pores small, along the commissures. 24. *S. mendocinum*.
- Chlorophyl-cells of the branch-leaves truncate elliptic or rectangular to trapezoidal in section, with equal exposure on both surfaces or slightly broader on the inner surface; or, if with broader exposure on the outer surface, the lumen lenticular and central or nearly so.
- Hyaline cells of the branch-leaves fibrillose.
- Chlorophyl-cells of the branch-leaves exposed equally on both surfaces or more broadly on the outer one. 25. *S. subsecundum*.
- Chlorophyl-cells of the branch-leaves usually exposed a little more broadly on the inner surface.
- Pores on the outer surface of the branch-leaves, if present, never more than 2 per cell. 26. *S. Pylaesii*.
- Pores on the outer surface of the branch- or stem-leaves always more than 2 per cell. 27. *S. cyclophyllum*.
- Hyaline cells of the branch-leaves without fibrils. 28. *S. macrophyllum*.
- Chlorophyl-cells of the branch-leaves exposed exclusively or more broadly on the inner surface; or, if with central lumen and approximately equal exposure, the pigment red.
- Stem-leaves fimbriate-lacinate in the apical part.
- Lacinate both at sides and apex. 29. *S. fimbriatum*.
- Lacinate only across the broad truncate apex. 30. *S. Girgensohnii*.
- Stem-leaves not notably lacinate in the apical part.
- Outer walls of the cortical cells of the stem porose, mostly 1 pore per cell.
- Outer walls of the cortical cells of the stem not normally porose. 31. *S. robustum*.
- Hyaline cells of the branch-leaves smaller, their free convexity on the outer surface mostly less than one half their diameter.
- Pigment brown. 32. *S. fuscum*.
- Pigment red.
- Branch-leaves gradually involute-pointed to the apex.
- Outer surface of the branch-leaves with very small round strongly ringed pores in the apical part.
- Outer surface of the branch-leaves with much larger elliptic pores. 33. *S. Warnstorffii*.
- Stem-leaves large, lingulate to lingu-late-ovate, one and one-half or more times as long as wide.
- Stem-leaves smaller, triangular to lingulate-triangular, mostly as wide as long. 34. *S. capillaceum*.
- Branch-leaves abruptly involute-pointed to the apex. 35. *S. quinquefarium*.
- Hyaline cells of the branch-leaves large in section, their free convexity on the outer surface usually more than one half their diameter. 36. *S. meridense*.
- Pigment brown, sometimes passing to purplish. 37. *S. plumulosum*.
- Pigment red.
- Margin of the branch-leaves entire. 38. *S. tenerum*.
- Margin of the branch-leaves denticulate. 39. *S. tabulare*.

1. *Sphagnum magellanicum* Brid. Musc. Recent. 2¹: 24. 1798.

Sphagnum subbicolor Hampe, Flora 63: 440. 1880.

Sphagnum medium Lampr. Bot. Centr. 7: 313. 1881.

Sphagnum intermedium Ruz. ow, Arch. Nat. Dorpat 10: 465. 1894.

Sphagnum centrale C. Jens. Bil. Sv. Vet.-Akad. Handl. 21^{no}: 34. 1896.

Plants compact to robust, bright-green or variously tinged with brownish, red-brown or more commonly pink to purple-red. Wood-cylinder red or sometimes brown; cortical cells

of the stem in 3-4 layers, their walls very thin, reinforced by weak fibril-bands, the outer cells of varying shape and size, their pores rather large, round or often laterally elongate, 1 or 2 in each cell: stem-leaves large, long-lingulate to lingulate-spatulate, the border denticulate, hyaline only at the immediate apex; hyaline cells not divided, fibrillose only in the apical part of the leaf or not at all, the membrane largely resorbed on the outer surface: branches frequently short, in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, with the basal walls plane; cell-walls reinforced inwardly by fibril-bands, the outer wall frequently with a large round pore at the upper end: branch-leaves imbricate or spreading, broadly ovate, the border denticulate especially toward the apex; hyaline cells fibrillose with weak fibril-bands, rhomboidal, 4-7 times as long as wide, often much shorter above, on the inner surface with very few pores confined to the apical and lateral regions where they occur in the corners of the cells, on the outer surface with rather numerous large elliptic pores in the cell-corners and along the commissures, 4-10 per cell, fewer in short cells near the apex, passing into single membrane-gaps of the apex; chlorophyl-cells elliptic in section, entirely enclosed or rarely slightly exposed on the inner or both surfaces, walls of the empty cells smooth; hyaline cells hardly convex on the inner surface and slightly if at all so on the outer, at most about one eighth of the diameter of the cell; resorption-furrow present.

Dioicous. Antheridial branches and leaves hardly differentiated, the latter slightly more pigmented than the others (red or brown). Fruiting branches erect, often elongate; perichaetial leaves ovate, the upper two-thirds and the border nearly to the base of normal structure with hyaline cells fibrillose and porose, the remaining portion consisting of uniform narrow cells with pitted walls: capsule dark-brown: spores brown-yellow, 25-30 μ in diameter, minutely papillose.

TYPE LOCALITY: Region of Magellan Straits in South America.

DISTRIBUTION: Labrador southward to Alabama and Florida; Michigan; Minnesota; California; Vancouver Island to Alaska; Bermuda; also in Europe, Asia, and South America.

ILLUSTRATIONS: Brid. Musc. Recent. 2¹: pl. 5, f. 1; G. Roth, Eur. Torfm. pl. 1, f. 3.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 165-170; Macoun, Can. Musci 601, 662; Ren. & Card. Musci Am. Sept. Exs. 141, 252.

2. *Sphagnum papillosum* Lindb. Acta Soc. Sci. Fenn.

10: 280. 1872.

Sphagnum Waghornei Warnst. Hedwigia 33: 329. 1894.

Plants low, compact or slender to very robust, generally deeply tinged with brown to nearly black. Wood-cylinder brown to nearly black; cortical cells of the stem in 3-4 layers, their walls thin, with few and weak fibril-bands, the outer cells quadrilateral or somewhat irregularly shaped, often longer than wide, their pores rarely more than 1 or 2 in each cell, frequently small, always clearly defined: stem-leaves large, elongate-lingulate, or smaller and shorter, the toothed border narrowly hyaline toward the apex; hyaline cells frequently divided, without fibrils or more or less fibrillose, in the former case the membrane on the outer surface largely resorbed: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, with the basal walls plane; cell-walls generally reinforced inwardly by numerous fibril-bands, the outer wall often with a single large pore at the upper end: branch-leaves imbricate or slightly spreading, ovate, denticulate on the margin; hyaline cells fibrillose, rhomboidal, 3-5 times as long as wide at base, in the upper half 2-3 times as long as broad, on the inner surface with small ringed pores in the cell-angles, and often in the apical and lateral portions of the leaf with large round pores in the central part of the cell, 1-5 per cell, on the outer surface with rounded or elliptic pores in the corners and along the commissures, 4-10 per cell, passing into large membrane-gaps in the short cells of the cucullate apex; chlorophyl-cells truncate elliptic or nearly lenticular in section, usually about equally exposed on both leaf-surfaces, the lumen narrowly lenticular and more or less central; inner walls of hyaline cells where overlying chlorophyl-cells densely and finely papillose, the papillae sometimes reduced or lacking; hyaline cells somewhat convex on the outer surface, about one fourth of the diameter of the cell; resorption-furrow present.

Dioicous, rarely fruiting. Antheridial branches and leaves hardly differentiated. Fruiting branches erect; perichaetial leaves large, elongate-ovate, the upper region and border

throughout of normal structure with hyaline cells fibrillose and porose, the central basal portion of uniform elongate cells without fibrils or pores: capsule globose, brown: spores yellow, about $28\ \mu$ in diameter, papillose.

TYPE LOCALITY: Finland.

DISTRIBUTION: Labrador southward to New Jersey; Vancouver Island; Alaska; reported from Indiana, Wisconsin, and Washington; also in northern Europe and Asia.

ILLUSTRATIONS: Braithw. Sphag. pl. 4; G. Roth, Eur. Torfm. pl. I, f. 4.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 162, 163.

3. *Sphagnum erythrocalyx* Hampe; C. Müll. Syn. 1: 92. 1848.

Sphagnum perichaetiale Hampe; C. Müll. Syn. 1: 93. 1848.

Sphagnum guadalupense Schimp.; Besch. Ann. Sci. Nat. VI. 3: 264. 1876.

Sphagnum Husnoti Schimp.; Besch. Ann. Sci. Nat. VI. 3: 264. 1876.

Sphagnum Guyoni Warnst. Deuts. Bot. Monats. 2: 17. 1884.

Sphagnum Wrightii C. Müll. Flora 70: 411. 1887.

Sphagnum ludovicianum Warnst. Hedwigia 30: 161. 1891.

Sphagnum Sintenisi C. Müll. Hedwigia 37: 219. 1898.

Sphagnum brevicaulis Warnst. Hedwigia 39: 108. 1900.

Sphagnum Harperi Warnst. Beih. Bot. Centr. 16: 250. 1904.

Sphagnum Earlei Warnst. in Engler, Pflanzenreich Sphag. 449. 1911.

Sphagnum Huntii Warnst. in Engler, Pflanzenreich Sphag. 521. 1911.

Plants small and compact to slightly robust, generally tinged with brownish-red, sometimes dark purplish-brown to nearly black. Wood-cylinder brown to dark purple-red; cortical cells of the stem in 3-4 layers, their walls very thin, reinforced by few rather distant fibril-bands, the outer cells of varying shape, often considerably longer than broad, their pores rounded, 1 or 2 per cell: stem-leaves very small or sometimes much enlarged, broad-lingulate to lingulate-spatulate, the border denticulate, slightly hyaline toward the apex; hyaline cells commonly divided, frequently by intersecting cross-walls, into 4 compartments, in large hemi-isophyllous leaves fibrillose, in smaller ones the fibrils reduced or lacking, with pores or membrane-gaps corresponding: branches usually short, in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, with the bases plane or slightly receding; cell-walls reinforced inwardly by fibril-bands which may be considerably reduced, the outer wall frequently showing a pore in the upper end: branch-leaves imbricate or slightly spreading, ovate with a broad apex, somewhat denticulate on the edge; hyaline cells strongly fibrillose, rhomboidal, 4-6 times as long as wide, shorter in the apex, on the inner surface with ringed pores of various shapes and sizes in the corners of the cells and along the commissures, more numerous in the apical and lateral regions of the leaf, on the outer surface with rather large pores in threes at adjacent cell-angles and much smaller strongly ringed elliptic pores near the commissures, more numerous toward the apex of the leaf, 4-12 per cell, in the immediate apex passing into irregular membrane-gaps; chlorophyl-cells in section nearly rectangular, varying to lenticular, exposed equally on both surfaces or rarely somewhat included on the outer surface, the lumen large, long-lenticular, central; inner cell-walls smooth throughout in the type and most or all North American specimens; hyaline cells slightly convex on the inner surface, rather more so on the outer, not exceeding one fourth of the diameter of the cell; resorption-furrow present.

Dioicous. Perichaetial leaves large, elongate-lingulate, the apical part and narrow border downward of normal structure, its hyaline cells fibrillose and porose, the central and basal portion consisting of uniform narrow cells without pores or fibrils, with pitted cell-walls: capsule small, dark-brown. spores yellow, about $25\ \mu$ in diameter, smooth.

TYPE LOCALITY: Brazil.

DISTRIBUTION: New Jersey southward to Florida and Louisiana; throughout the West Indies; British Honduras; also in South America.

ILLUSTRATIONS: Hedwigia 30: pl. 15, 16, 18, 21-23, passim.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 171, 172; Sull. Musci Cub. Wright. I; Husnot, Pl. Ant. 189.

4. *Sphagnum palustre* L. Sp. Pl. 1106. 1753.

Sphagnum cymbifolium Ehrh.; Hedw. Fundam. 2: 86. 1782.

? *Sphagnum vulgare* Michx. Fl. Bor. Am. 2: 285. 1803.

? *Sphagnum oblongum* Beauv. Prodr. Aethéog. 88. 1805.

Sphagnum glaucum H. Klinggr. Topogr. Fl. Westpr. 126. 1880.

Plants low and compact to robust, green or more or less tinged with brown. Wood-cylinder brown, cortical cells of the stem in 3 layers, their walls thin, reinforced by fibril-

bands, the outer cells quadrilateral to pentagonal, sometimes longer than wide, each with 1-4 irregularly rounded pores: stem-leaves large, elongate-lingulate or somewhat spatulate, the border toothed; hyaline cells not divided, narrow below, in the apex as wide as long, frequently somewhat fibrillose in the apical part, their membrane resorbed on the outer surface: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer; cell-walls reinforced inwardly by numerous fibril-bands, the outer wall frequently with a single large pore: branch-leaves imbricate or spreading to squarrose, ovate, denticulate on the margin; hyaline cells fibrillose, rhomboidal, 3-5 times as long as wide below, shorter in the cucullate apex, on the inner surface with elliptic to rounded pores in the cell-angles and few large round pores in the central portion of the cell, more numerous in cells near the margin of the leaf where 2-8 per cell, on the outer surface with large rounded pores in the ends of the cells and numerous smaller elliptic ringed ones along the commissures, 3-10 in all, in short cells of the cucullate apex the membrane resorbed in a single large opening: chlorophyl-cells narrowly isosceles-triangular in section with a short base exposed on the inner surface, their walls uniformly thin, the lumen triangular and nearer the inner surface; hyaline cells somewhat convex on the outer surface, not more than one fourth of the diameter of the cell; resorption-furrow present.

Dioicous. Antheridial branches hardly differentiated except as the antheridial leaves are slightly more pigmented (brown). Fruiting branches erect; perichaetial leaves elongate-ovate, the upper portion and broad border downward of normal structure with fibrillose and porose hyaline cells, the remaining portion of uniform narrow cells 5-10 times as long as wide: capsule brown: spores yellow, 20-28 μ in diameter, the surface distinctly granular-roughened.

TYPE LOCALITY: Europe.

DISTRIBUTION: Newfoundland southward to Florida and Texas; Ohio; Wisconsin; California northward to Alaska; also in Europe and Asia.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 32, f. 1; G. Roth, Eur. Torfm. pl. 1, f. 1.

EXSICC.: Sull. Musci Allegh. 199; Eaton & Faxon, Sphag. Bor. Am. Exs. 156, 157, 159-161; Ren. & Card. Musci Am. Sept. Exs. 151.

5. *Sphagnum henryense* Warnst. Hedwigia 39: 107. 1900.

Plants fairly robust, pale-green. Wood-cylinder brown; cortical cells of the stem in 3 layers, their inner walls reinforced by fibril-bands, the outer cells generally quadrilateral, seldom longer than broad, each with 2-5 rounded pores: stem-leaves large, lingulate-spatulate, their hyaline cells generally not divided, somewhat fibrillose, the membrane largely resorbed on the outer surface: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, with prominent fibril-bands, the outer wall sometimes showing a large pore in the upper end: branch-leaves spreading, broadly ovate, denticulate; hyaline cells fibrillose, rhomboidal, 6-8 times as long as wide at the base, gradually shorter above, on the inner surface with a few ringed pores in the corners of the cells in the apical part of the leaf, the side-regions with rather large rounded pores in the middle portion of the cell, in the marginal row of cells sometimes very numerous (up to 12) in 2 rows, on the outer surface with very numerous, small, elliptic pores along the commissures, 5-20 per cell, with single large membrane-gaps in the apical cells; chlorophyl-cells narrowly triangular in section with the base exposed on the inner surface, the lumen of similar shape; inner surface of hyaline cells where overlying chlorophyl-cells beset with a net-work of prominently projecting ridges, especially in the lower part of the leaf; hyaline cells convex on the outer surface, up to one fourth of the diameter of the cell or slightly more; resorption-furrow present. Antheridia and archegonia unknown.

TYPE LOCALITY: Cape Henry, Virginia.

DISTRIBUTION: Delaware, Virginia, Georgia, and Louisiana.

6. *Sphagnum imbricatum* Hornsch.; Russow, Beitr.

Torfm. 21. 1865.

Sphagnum Austini Sull.; Aust. Musci App. 3. 1870.

Plants low and compact to fairly robust, green or more or less tinged with brown. Wood-cylinder brown; cortical cells of the stem in 3-4 layers, their walls thin, reinforced by fibril-bands, the outer cells irregularly quadrilateral to pentagonal, generally longer than wide, each

with 4-8 or even 10 irregularly rounded pores: stem-leaves of fair size, lingulate to slightly spatulate, the hyaline border less wide and conspicuous than in the next species, the hyaline cells sometimes divided, near the apex of the leaf about as wide as long, narrower below, their membrane on the inner surface without pores or fibril-bands, on the outer surface entirely resorbed: branches normally in fascicles of 5, 2 spreading, their cortical cells in a single layer, best developed in the lower and middle portion of the branch, with the basal wall plane or nearly so; cell-walls reinforced inwardly by numerous fibril-bands, the outer wall sometimes showing a single pore or rarely also a second one; cortical cells of both stem and branches showing on that part of their inner surface immediately overlying the wood-cylinder a corrugation consisting of alternating ridges and grooves which continue the direction of the fibril-bands but the ridges are lower and broader in section and much more numerous than the bands: leaves of spreading branches imbricate or sometimes squarrose-spreading, ovate, not bordered, but denticulate along the margin; hyaline cells fibrillose throughout, 4-6 times as long as wide except in the cucullate apex where they are shorter, on the inner surface with few small ringed pores in the corners of the cells in the apical part of the leaf and also very large rounded pores, 2-12 in each cell, their diameter often nearly equal to the width of the cell, arranged in a single row except toward the sides of the leaf where the row is sometimes double, in rare cases these pores reduced or lacking, on the outer surface with very numerous elliptic pores along the commissures, 4-12 in each cell except in short cells of the cucullate apex where the membrane is largely resorbed forming a single large opening in each cell: chlorophyl-cells exposed on the inner surface, equilateral-triangular in section; hyaline cells very convex on the outer surface, up to one half of the diameter of the cell; inner walls of hyaline cells where overlying chlorophyl-cells beset with fringe-fibrils, *i. e.*, approximately parallel, somewhat irregularly running ridges, which may be lacking in the upper part of the leaf; resorption-furrow present.

Dioicous. Atheridial branches and leaves hardly differentiated except as the latter are slightly more pigmented (brown). Fruiting branches erect; perichaetial leaves large, ovate, with a hyaline toothed border especially toward the apex, the outer cells next the border of two sorts as in normal leaf-structure, the hyaline ones fibrillose and porose, the cells of the remaining inner portion of the leaf uniform, narrow, without fibrils or pores: capsule globose, brown: spores deep-yellow, 20-25 μ in diameter, smooth.

TYPE LOCALITY: Kamchatka.

DISTRIBUTION: Newfoundland and southward near the coast to Georgia, Alabama, and Mississippi; Indiana; Alaska; Cuba; also in Europe and Asia.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 1*; Braithw. Sphag. *pl. 3*; G. Roth, Eur. Torfm. *pl. 1, f. 2*.

EXSICC.: Aust. Musci App. 2; Eaton & Faxon, Sphag. Bor. Am. Exs. 151-153; Macoun, Can. Musci 575.

Sphagnum imbricatum affine (Ren. & Card.) Warnst. Hedwigia 28: 370. 1889. (*Sphagnum affine* Ren. & Card. Rev. Bryol. 12: 44. 1885.) Differs from the type in the complete lack of fringe-fibrils on the walls of the hyaline cells of the branch-leaves. Eastern Canada southward to Florida; West Virginia; also in Europe. EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 154, 155.

7. *Sphagnum portoricense* Hampe, Linnaea 25: 359. 1853.

Sphagnum Sullivantianum Aust. Am. Jour. Sci. II. 35: 253. 1863.

Sphagnum Herminieri Schimp.; Besch. Ann. Sci. Nat. VI. 3: 265. 1876.

Plants robust to very robust, more or less tinged with brown. Wood-cylinder brown; cortical cells of the stem in 3-4 layers, their walls thin, reinforced by fibril-bands, the outer cells irregularly quadrilateral to hexagonal, sometimes wider than long, each with 1-4 irregularly rounded pores: stem-leaves of medium size, lingulate, with a broad finely meshed hyaline border; hyaline cells occasionally divided, near the apex of the leaf as wide as long, narrower below, their membrane on the inner surface often showing small pores and traces of fibrils, especially in cells near the apex of the leaf, on the outer surface almost entirely resorbed: branches in fascicles of 4 or 5, 2 robust, horizontal or decurved, the others pendent, closely applied to the stem, their cortical cells in a single layer, increasing in size toward the apex of the branch, each cell inserted by a saccate to funnel-shaped prolongation into the one beneath; cell-walls reinforced inwardly by numerous fibril-bands, corrugated where overlying the wood-cylinder as in the next preceding species, the outer surface without pores: leaves of spreading branches smaller near the base of the branch, broadly ovate with cordate to auriculate base,

hyaline-bordered as the stem-leaves; hyaline cells nearly as broad as long in the apical part of the leaf, below narrower, 2-3 times as long as wide, on the inner surface with rather numerous small pores in the angles of the cells and numerous larger rounded pores in the lateral regions, on the outer surface the membrane almost entirely resorbed in the upper part of the leaf, in the lower part with very numerous elliptic pores along the commissures: leaves nearer the apex of the branch much larger, denticulate but lacking the hyaline border, the pores about as in the other leaves, but the membrane on the outer surface resorbed only in a few apical cells, the pores on the inner surface relatively not so numerous: chlorophyl-cells exposed on the inner surface of the leaf, in section equilateral-triangular; inner walls of hyaline cells where in contact with chlorophyl-cells normally beset with fringe-fibrils (these however sometimes present only in the lower part of the leaf or entirely lacking); hyaline cells very convex on the outer surface, up to one half of the diameter of the cell; resorption-furrow present. Antheridial branches and leaves hardly differentiated. Fruit unknown.

TYPE LOCALITY: Porto Rico.

DISTRIBUTION: New Jersey; Georgia; Florida; Porto Rico; Guadeloupe.

ILLUSTRATIONS: Sull. Ic. Musc. *pl.* 2; Braithw. Sphag. *pl.* 2.

EXSICC.: Sull. & Lesq. Musci Bor. Am. ed. 2. 2; Aust. Musci App. 1; Husnot, Pl. Ant. 190; Eaton & Faxon, Sphag. Bor. Am. Exs. 149, 150.

8. *Sphagnum compactum* DC. Fl. Fr. 2: 443. 1805.

Sphagnum rigidum Schimp. Mém. Sphaig. 72. 1857.

Plants short and compact, rarely taller and somewhat robust, dirty-white, especially when dry, or sometimes with a brownish tinge or partly or entirely green. Wood-cylinder brown; cortical cells of the stem in 2-3 layers, large, with thin walls, without fibrils, the outer cells quadrilateral to pentagonal, sometimes longer than wide, without pores: stem-leaves minute, concave, short-lingulate to triangular-lingulate, sometimes more or less lacerate at the apex; hyaline cells without fibrils or divisions, on the inner surface with a membrane-gap in the upper end of each cell, small and rounded or toward the apex of the leaf irregular in shape and often occupying a large part of the cell, the membrane of the outer surface without pores, but with longitudinal membrane-pleats, the cell-walls pitted, especially in the narrow cells of the margin: branches short, compactly arranged in close fascicles of 4 or 5, 2 stronger, spreading or ascending, rigid, the others pendent; their cortical cells in a single layer, without fibrils, the apex of each cell produced outwardly into a slight neck which ends in a pore: branch-leaves imbricate to strongly squarrose, large, ovate-bastate, slightly denticulate on the edge, involute, ending in a truncate toothed apex; hyaline cells strongly fibrillose, irregularly hexagonal-rhomboidal, 6-8 times as long as wide at the base, shorter above to twice as long as wide in the apex, on the inner surface with ringed pores in the cell-angles, generally then in threes in adjacent corners, commonly 3 in each cell, on the outer surface with very numerous large rounded pores near the commissures, mostly included within a larger fibril-ring, 4-8 per cell besides many such fibril-rings without perforation (pseudopores); chlorophyl-cells in section elliptic, central or nearer the outer surface, entirely included; inner walls of hyaline cells smooth; hyaline cells not at all or very slightly convex on the outer surface, more so on the inner where up to one fifth of the diameter of the cell; resorption-furrow present.

Monoicous and often fruiting. Antheridia few on undifferentiated pendent or spreading branches. Fruiting branches erect with few large subsecond perichaetal leaves, the latter ovate-lanceolate, long-acuminate, the tip consisting entirely of narrow cells with pitted walls, which type of cells is continued downward in a narrow border, the rest of the leaf composed of chlorophyl-cells and hyaline cells with fibrils and pores much as in ordinary branch-leaves, the non-fibrillose cells sometimes showing a membrane-gap in the center of the inner surface; chlorophyl-cells nearer the outer surface, where sometimes slightly exposed; resorption-furrow lacking: capsule small on a slender pedicel, brown: spores brown-yellow, 24-28 μ in diameter, slightly granular-roughened.

TYPE LOCALITY: France.

DISTRIBUTION: Greenland; Labrador southward to Florida and Alabama; Illinois; Vancouver Island to Alaska; also in Europe and Asia.

ILLUSTRATIONS: Schimp. Mém. Sphaig. *pl.* 18; Schimp. Versuch Torfm. *pl.* 18; Braithw. Sphag. *pl.* 13; G. Roth, Eur. Torfm. *pl.* 3, f. 9.

EXSICC.: Sull. & Lesq. Musci Bor. Am. ed. 2. 16-18; Eaton & Faxon, Sphag. Bor. Am. Exs. 115-120; Macoun, Can. Musci 12; Ren. & Card. Musci Am. Sept. Exs. 254, 255.

9. *Sphagnum strictum* Sull. Musci Allegh. 201. 1845.

Sphagnum humile Schimp.; Sull. in A. Gray, Man. ed. 2. 611. 1856.

Sphagnum mexicanum Mitt. Jour. Linn. Soc. 12: 624. 1869.

Sphagnum Garberi Lesq. & James, Proc. Am. Acad. 14: 133. 1879.

Sphagnum domingense C. Müll. Hedwigia 37: 219. 1898. (Fide Warnst.)

Plants low and compact to rather tall and robust, straw-yellow or sometimes tinged with light-green. Wood-cylinder yellowish-green; cortical cells of the stem in 1-3 layers, thin-walled, without fibrils, the outer cells quadrilateral, commonly longer than broad, without pores: stem-leaves small, triangular to lingulate-triangular, concave, with a border of narrow cells; hyaline cells not divided, without fibrils except in hemi-isophyllous forms, the membrane-pleats not prominent, if present confined to a few apical cells, on the inner surface an irregular membrane-gap in each cell, near the apex of the leaf occupying nearly the whole of the cell, the cell-walls of the border only slightly pitted: branches close, normally in fascicles of 5, 2 spreading, their cortical cells in a single layer, without fibril-bands, uniform, the upper end terminating in very short outwardly turned neck and pore: branch-leaves long-squarrose, ovate-lanceolate, involute above, truncate and toothed at the apex, the margin denticulate; hyaline cells fibrillose, elongate-rhomboidal, 4-8 times as long as wide, on the inner surface with strongly ringed elliptic pores in the corners of the cells, generally then in pairs or threes at adjacent angles, 2-4 per cell, on the outer surface with more numerous pores in the vicinity of the commissures, strongly ringed, 5-15 per cell, sometimes less numerous, 1-4 per cell, pseudopores lacking: chlorophyll-cells in section rounded-triangular, enclosed on the inner surface of the leaf, exposed with a thick wall on the outer surface, the lumen large, lenticular; inner walls of hyaline cells where overlying chlorophyll-cells minutely papillose or rarely smooth; hyaline cells very slightly convex on the outer surface, much more so on the inner where up to one third of the diameter of the cell.

Diocious so far as observed and not commonly fruiting. Antheridia on undifferentiated branches. Fruiting branches short; perichaetial leaves few, more or less secund, ovate-lanceolate, strongly involute, obtuse to irregularly truncate at the apex, the hyaline cells fibrillose except in the basal part, border, and apex, where they are narrow-linear and generally show a single round membrane-gap on the inner surface, the fibrillose cells with numerous pores along the commissures on the inner surface, on the outer surface with only occasional end-pores; outer border of 2-3 rows of narrow cells lacking a resorption-furrow: capsule small, brown: spores greenish-yellow, 35-45 μ in diameter, smooth or somewhat granular-roughened.

TYPE LOCALITY: "Devil's Court House," North Carolina.

DISTRIBUTION: Newfoundland southward to Florida, Alabama, and Mexico; reported from Labrador and the West Indies; also in Norway.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 3; Hedwigia 29: pl. 11, f. 7-9; pl. 12, f. 11-13; pl. 14, f. m, n; C. Roth, Eur. Torfm. pl. 11, f. 8.

EXSICC: Sull. Musci Allegh. 201; Sull. & Lesq. Musci Bor. Am. 14; Eaton & Faxon, Sphag. Bor. Am. Exs. 122; Macoun, Can. Musci 594; Ren. & Card. Musci Am. Sept. Exs. 256.

10. *Sphagnum Wulfianum* Girg. Arch. Nat. Dorpat 2: 173. 1860.

Plants small to rather robust, green or variously tinged with reddish or brown. Wood-cylinder hard, reddish-brown; cortical cells of the stem in 2-4 layers, rather small, but sharply set off from the cells of the wood-cylinder, their walls moderately thick, the outer cells quadrilateral, mostly longer than broad, without fibrils or pores: stem-leaves small, triangular-lingulate, slightly concave, involute to an abrupt point at the apex, the border entire, narrow; hyaline cells narrowly rhomboidal, wider near the apex, without fibrils, often divided, their membrane on the outer surface showing irregularly shaped membrane-gaps in the upper part of the leaf, passing below into longitudinal membrane-pleats, on the inner surface similar: branches in large fascicles of 6-12, 3 or more stronger, spreading, the others delicate, closely applied to the stem, their cortical cells in a single layer, without fibrils; retort-cells differentiated, often a second shorter one above the first, the neck short: branch-leaves with sharp spreading points when dry, narrowly ovate-lanceolate, involute-tubulose to a sharp point, toothed across the apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly

linear-rhomboidal, 10-14 times as long as wide at base, shorter above to 6-8 times, on the inner surface with few and inconspicuous pores in the ends and corners of the cells, rarely up to 3-4 per cell, on the outer surface with small ringed pores along the commissures, 4-8 per cell in the upper half of the leaf, generally fewer in the lower half; chlorophyl-cells truncately elliptic in section, with equal exposure on both surfaces or slightly broader on the outer surface, the lumen lenticular, central; inner walls of hyaline cells where overlying chlorophyl-cells very finely papillose; hyaline cells very slightly convex, more so on the outer surface where hardly more than one eighth of the diameter of the cell.

Diocious, sometimes monoicous. Antheridial branches sometimes produced in great profusion; antheridia in catkins near the end of long spreading, otherwise normal branches; antheridial leaves essentially as others, but more strongly pigmented and with fibrils reduced or lacking in the hyaline cells of the basal portion. Fruiting branches short, erect; perichaetial leaves ovate with an abruptly pointed involute tip toothed across the apex, the border entire, of narrow cells, the rest of the leaf of both kinds of cells except the tip, where the hyaline cells are suppressed and the cell-walls more or less pitted; hyaline cells without fibrils or membrane-gaps: capsule dark-brown: spores brown-yellow, 18-20 μ in diameter, finely granular-roughened.

TYPE LOCALITY: Livonia, Russia.

DISTRIBUTION: Eastern Canada southward to Connecticut; New York; Minnesota; Vancouver Island; reported from Greenland; also in northern Europe and reported from Siberia.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. pl. 9; Braithw. Sphag. pl. 22; G. Roth, Eur. Torfm. pl. 3, f. 8.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 73-75; Macoun, Can. Musci 11.

11. *Sphagnum Ångströmi* Hartm. f.; Hartm. Skand. Fl. ed. 7. 399. 1858.

Plants fairly robust, yellowish-green. Wood-cylinder yellowish-green; cortical cells of the stem in 3-4 layers, large with thin walls, the outer cells irregularly quadrilateral to pentagonal, sometimes about as wide as long, without fibrils, rarely with a pore near the upper end of the cell: stem-leaves of medium size, lingulate, slightly concave, somewhat lacerate across the apex, the border narrow and indistinct above, much broadened toward the base where the walls of its cells are strongly pitted; hyaline cells rhomboidal, narrow below, in the apical part nearly as wide as long, without fibrils or divisions, their membrane on the outer surface almost entirely resorbed in cells of the apical part, the gaps decreasing in size toward the base, passing into longitudinal membrane-pleats, on the inner surface more nearly intact, resorbed in 2-3 rows of cells of the immediate apex, with occasionally very small gaps in the ends of cells further down, and with longitudinal membrane-pleats throughout: branches in fascicles of 5, 2 or 3 stronger, spreading, their cortical cells in a single layer, the retort-cells with an inconspicuous neck, commonly a second shorter one above the first: branch-leaves closely imbricate when dry, broadly ovate, very strongly concave, with a broadly truncate toothed apex (about 10 teeth across the apex), the border of 1-2 rows of narrow cells, entire except in the immediate vicinity of the apex; hyaline cells fibrillose, linear-rhomboidal, 6-8 times as long as wide at the base, shorter in the immediate apex, on the inner surface with a few medium-sized pores in the cell-angles and near the commissures, fairly numerous only in cells near the outer edge, where they number up to 8 per cell, rapidly diminishing in number inwardly and after a few rows of cells lacking entirely, on the outer surface the pores more numerous, similar or somewhat elliptic, 6-14 per cell: chlorophyl-cells truncately elliptic in section, exposed about equally on both surfaces, the lumen elliptic, exactly central; hyaline cells slightly convex on both surfaces, rather more so on the outer where the convexity is one sixth to one fifth of the diameter of the cell.

Diocious. Antheridia on spreading branches; antheridial leaves much smaller than the others, not strongly pigmented, yellowish-green, saccate at the base, where the fibrils are considerably reduced or lacking. Fruiting branches erect, short; perichaetial leaves lingulate, broadly rounded and often rent at the apex, showing both kinds of cells in the upper middle portion where the hyaline cells are small, undivided, without fibrils, their membrane

on the inner surface entire, on the outer surface much resorbed: capsule dark-brown: spores brown-yellow, about $25\ \mu$ in diameter, very minutely granular-roughened.

TYPE LOCALITY: Lapland.

DISTRIBUTION: Alaska and Yukon; also in arctic and subarctic Europe and Siberia.

ILLUSTRATIONS: Braithw. Sphag. *pl.* 11; G. Roth, Eur. Torfm. *pl.* 4, *f.* 3.

12. *Sphagnum squarrosum* Crome, Samml. Deuts.

Laubm. 24. 1803.

Plants generally tall and very robust, bright-green or sometimes yellowish. Wood-cylinder green to reddish-brown; cortical cells of the stem in 2-3 layers, of irregular size and shape, with thin walls, the outer cells narrowly quadrilateral, much longer than broad, without fibrils or pores: stem-leaves large, long ovate-lingulate, slightly concave, the apex weakly lacerate-fimbriate, passing into a suggestion of a hyaline border and this into an indistinct border of narrow cells extending to the base; hyaline cells in the apical portion rhomboidal, short, not more than 2-3 times as long as wide, in basal side-regions of the same length but narrower, mostly undivided and without fibrils, the membrane on the outer surface almost completely resorbed, on the inner surface the membrane-gaps confined to cells of the immediate apex, the membrane otherwise entire, frequently with longitudinal membrane-pleats: branches often very long, in fascicles of 5, 2 spreading, their cortical cells in a single or double layer, without fibrils, the retort-cells slightly differentiated with inconspicuous neck: branch-leaves strongly squarrose from the center, sometimes spreading or nearly imbricate, large, ovate-hastate, broadening rapidly from the base, then suddenly contracting to an acute, involute, toothed apex, the border entire, of 2-3 rows of long narrow cells; hyaline cells strongly fibrillose throughout, narrowly rhomboidal, 4-8 times as long as wide, shorter toward the apex and much broader in the middle side-regions, on the inner surface with rather numerous round pores in the ends of the cells and near the commissures, 4-10 per cell, except in the middle basal portion where they are lacking, most numerous and largest in large cells of the middle side-regions, on the outer surface less numerous, in the ends and corners of the cells, generally 1-3 per cell, except in the middle basal portion where they are large and numerous in a single or double row, sometimes 10 or more per cell, with pseudopores also in apical cells; chlorophyll-cells in section triangular with the base exposed on the outer surface or trapezoidal with a narrow exposure also on the inner surface; inner walls of the hyaline cells where overlying the chlorophyll-cells often strongly papillose; hyaline cells convex on both surfaces, on the outer only slightly, one sixth or one fifth, on the inner rather more, one fourth or one third of the diameter of the cell.

Monoicous. Antheridial catkins conspicuous; antheridial leaves often deeply pigmented, brown, spreading, ovate, strongly involute, smaller than the normal branch-leaves, the fibrils in cells of basal region weak or lacking. Fruiting branches erect, long; perichaetial leaves long-lingulate, strongly involute, the apex truncate or retuse, fimbriate, their texture as in the stem-leaves; hyaline cells on the outer surface with large membrane-gaps, on the inner surface entire with longitudinal membrane-pleats: capsule brown: spores brownish-yellow, 20-25 μ in diameter, papillose.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador southward to New Jersey; Pennsylvania; Ohio; Michigan, Wisconsin, Minnesota, Colorado, California northward to Alaska and adjacent islands; also in Europe and Asia.

ILLUSTRATIONS: Weber & Mohr, Nat. Reise Schwed. *pl.* 2, *f.* 1, *a, b*; Schimp. Mém. Sphaig. *pl.* 17; Schimp. Versuch Torfm. *pl.* 17; Braithw. Sphag. *pl.* 14; G. Roth, Eur. Torfm. *pl.* 5, *f.* 1.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 7; ed. 2. 9; Eaton & Paxon, Sphag. Bor. Am. Exs. 69-72; Macoun, Can. Musci 10, 611.

13. *Sphagnum teres* (Schimp.) Ångstr.; Hartm. Skand.

Fl. ed. 8. 417. 1861.

Sphagnum squarrosum teres Schimp. Versuch Torfm. 64. 1858.

Sphagnum squarrosulum Lesq. Mem. Calif. Acad. 1: 3. 1868.

Plants mostly rather slender, green or frequently more or less tinged with brown. Wood-cylinder green to brown, cortical cells of the stem in 3-4 layers, large with thin walls, without

fibrils or pores: stem-leaves very large, long-lingulate, slightly concave, weakly fimbriate-lacerate at the apex, the border of narrow cells dissolved at the apex; hyaline cells in the apical portion of the leaf rhomboidal, 3-4 times as long as wide, toward the base much narrower, rarely divided in the basal portion, without fibrils, the membrane on the outer surface almost entirely resorbed, on the inner surface the membrane-gaps confined to the apical cells, those below showing generally longitudinal membrane-pleats: branches long and slender, in fascicles of 5, 2 or 3 spreading, their cortical cells in a single layer, the retort-cells with an inconspicuous neck: branch-leaves mostly imbricate, sometimes more or less squarrose, small, ovate-lanceolate, strongly involute toward the toothed apex; the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose throughout, rhomboidal, 3-8 times as long as wide, on the inner surface with numerous large pores, 3-6 per cell, on the outer surface similar; chlorophyll-cells triangular to trapezoidal in section, with broader or exclusive exposure on the outer surface, the lumen triangular; inner walls of hyaline cells where overlying chlorophyll-cells often strongly papillose; hyaline cells convex only on the inner surface, one fourth to one third of the diameter of the cell.

Dioicous. Antheridia in catkins; antheridial leaves often brownish, otherwise hardly differentiated from normal branch-leaves, except that the basal region shows cells with fibril-bands weakened or lacking. Fruiting branches erect, often elongate; perichaetial leaves long-lingulate to spatulate, irregularly eroded at the apex, which shows a tendency to a hyaline border, the border otherwise lacking; both kinds of cells throughout; hyaline cells without fibrils or divisions, the membrane on the outer surface mostly resorbed, on the inner surface with some gaps in the narrow cells of the sides and base, otherwise entire, with longitudinal or irregular membrane-pleats: capsule dark-brown: spores greenish-yellow, about 25μ in diameter, finely granular-roughened.

TYPE LOCALITY: Sweden.

DISTRIBUTION: Greenland; Labrador southward to New Jersey; New York; Michigan; Colorado; California northward to Alaska; also in Europe and reported from Asia.

ILLUSTRATIONS: Sull. Ic. Muse. Suppl. *pl.* 4; Braithw. Sphag. *pl.* 15; G. Roth, Eur. Torfm. *pl.* 5, *f.* 2, 3.

EXSTCC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 63-68; Ren. & Card. Musei Am. Sept. Exs. 257.

14. *Sphagnum Lindbergii* Schimp. Versuch Torfm. 67.. 1858.

Plants more or less robust, yellowish or generally considerably tinged with brown. Wood-cylinder brown; cortical cells of the stem in 2-4 layers, very large and thin-walled, the outer cells quadrilateral, without pores: stem-leaves large, broadly spatulate, strongly auricled at the base, widely lacerate at the truncate apex, with a border of narrow cells at the side, wider toward the base; hyaline cells wide in the apex, narrowing toward the base, the upper cells sometimes divided, in the basal part more or less fibrillose, the membrane resorbed on both surfaces in the apical part of the leaf, the gaps reduced and disappearing downward: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, the retort-cells with an inconspicuous neck: branch-leaves slightly undulate when dry, tending to be five-ranked when moist, sometimes slightly subsecund, ovate-lanceolate to lanceolate, involute especially toward the toothed apex, the border entire, of 3-5 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, in the basal portion 12-15 times as long as wide, shorter above to about 8 times near the apex, the pores of the inner surface few in the apical part, in the ends and corners of the cells, up to 3-4 per cell, on the outer surface the pores very small, ringed, in the ends and corners, not exceeding 4 per cell, with pseudopores also in the apical cells: chlorophyll-cells in section triangular with curving legs to trapezoidal or rarely truncately elliptic, exposed on both surfaces or only on the outer one, the lumen elliptic to triangular, central or slightly nearer the outer surface; hyaline cells but slightly convex on either surface, more so on the inner, where up to one fifth of the diameter of the cell.

Dioicous or monoicous. Antheridia borne on undifferentiated spreading or pendent branches. Fruiting branches short; perichaetial leaves spatulate, the lower part consisting of uniform narrow cells with pitted walls, in the upper one third or one half with both kinds of cells, the hyaline cells with longitudinal membrane-pleats especially on the outer surface, passing to elongate gaps in the upper cells, the apex irregularly lacerate as in the stem-leaves: spores greenish-yellow, 24-28 μ in diameter, very slightly granular-roughened.

TYPE LOCALITY: Lapland.

DISTRIBUTION: Greenland; Labrador southward to New Hampshire (Mt. Monroe) and New York (Mt. Whiteface); Vancouver Island to Alaska; also in northern Europe and reported from Asia.

ILLUSTRATIONS: Schimp. Versuch Torfm. *pl.* 25; *pl.* 27, *f.* 1; Braithw. Sphag. *pl.* 23; G. Roth, Eur. Torfm. *pl.* 5, *f.* 4.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 79-83; Macoun, Can. Musci 574; Ren. & Card. Musci Am. Sept. Exs. 149.

15. *Sphagnum riparium* Angstr. Oefv. Sv. Vet.-Akad.

Förh. 21: 198. 1864.

Plants commonly tall and robust, green or more or less tinged with brown. Wood-cylinder green; cortical cells of the stem hardly differentiated, the outer cells of the stem narrow, many times longer than wide, without pores or fibrils: stem-leaves rather large, triangular-lingulate with a deep rent in the middle of the apex, the border formed by 4-6 rows of narrow cells with occasionally pitted walls; hyaline cells narrow, often once or twice divided, especially in the apical portion, without fibrils, the membrane on the inner surface almost entirely resorbed, on the outer surface with longitudinal membrane-pleats which pass to rents near the torn apex: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, the retort-cells with an inconspicuous neck: branch-leaves slightly undulate when dry with reflexed tips, ovate-lanceolate, strongly involute, the sharply acuminate toothed apex composed entirely of chlorophyll-cells, the border entire, of 2-5 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, in the basal portion 6-8 times as long as wide, shorter above, on the inner surface with irregularly rounded pores in the ends of the cells and elsewhere, mostly of nearly cell-width, less numerous toward the base of the leaf, on the outer surface toward the apex with small pores in the cell-ends and corners, 3-5 per cell, in the lower part of the leaf almost entirely confined to the ends of the cells: chlorophyll-cells trapezoidal in section with broader exposure on the outer surface, the lumen triangular; hyaline cells hardly convex on the outer surface, on the inner one fifth to one third of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves well differentiated, brown, with fibrils and pores lacking in the hyaline cells of their basal part. Fruiting branches erect, short; perichaetial leaves large, ovate, the apex retuse, the entire leaf composed of narrow vermicular cells with pitted walls: capsule brown, rather small, with a small operculum: spores yellow, 20-30 μ in diameter, minutely granular-roughened.

TYPE LOCALITY: Lapland.

DISTRIBUTION: Greenland; Labrador southward to the White Mountains of New Hampshire; British Columbia to Alaska; also in Europe and reported from Asia.

ILLUSTRATIONS: Braithw. Sphag. *pl.* 25, *f.* 2; G. Roth, Eur. Torfm. *pl.* 6, *f.* 12.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 85-87; Macoun, Can. Musci 526; Ren. & Card. Musci Am. Sept. Exs. 264.

16. *Sphagnum obtusum* Warnst. Bot. Zeit. 35: 478. 1877.

Plants robust, green or tinged yellowish or brownish. Wood-cylinder yellowish-green; cortical cells of the stem hardly differentiated, the outer cells of the stem long-quadrilateral, without fibrils or pores: stem-leaves medium-sized, triangular-lingulate, somewhat eroded at the broad apex but not cleft, the border of 3-6 rows of narrow cells above, slightly wider below; hyaline cells narrow, not divided, mostly without fibrils, their membrane on the inner surface largely resorbed, on the outer surface the resorption confined to a few apical cells: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, the retort-cells with an inconspicuous neck: branch-leaves somewhat undulate when dry with spreading tips, lanceolate, involute in the apical part, the apex toothed, the border entire, of 2-5 rows of very narrow cells; hyaline cells fibrillose, narrowly linear rhomboidal, in the basal portion 8-10 times as long as wide, shorter above to 6 times, on the inner surface with pores only in the ends of the cells, on the outer surface with similar pores, also in the lower side-regions with small round membrane thinnings visible only when the leaf is stained, these varying in number, in an irregular single or double row in each cell: chlorophyll cells triangular in section with the base exposed on the outer surface, the apex of the triangle just reaching the inner surface of the leaf, its legs frequently more or less curving and its apex well included; hyaline cells

not convex on the outer surface, considerably so on the inner, up to one fourth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, smaller than the normal branch-leaves.

TYPE LOCALITY: Germany.

DISTRIBUTION: Greenland: reported from Ontario; also in Europe and reported from Asia.

ILLUSTRATIONS: Verh. Bot. Ver. Prov. Brand. 32: *pl. 1, f. 47-50; pl. 2, f. t, u*; G. Roth, Eur. Torfm. *pl. 2, f. 1; pl. 6, f. 9; pl. 7, f. 6*.

17. *Sphagnum recurvum* Beauv. Prodr. Aethéog. 88. 1805.

Sphagnum pulchricoma C. Müll. Syn. 1: 102. 1848.

Sphagnum fallax H. Klinggr. Topogr. Fl. Westpr. 128. 1880.

Sphagnum riparioides Warnst. Hedwigia 47: 118. 1908.

Sphagnum amblyphyllum Warnst. in Engler, Pflanzenreich Spagh. 212. 1911.

Plants commonly more or less robust, bright-green or sometimes tinged yellowish or brownish. Wood-cylinder yellowish-green; cortical cells of the stem slightly if at all differentiated, the outer cells of the stem elongate-quadrilateral, without fibrils or pores: stem-leaves very small, triangular to triangular-lingulate, the apex mucronate to rounded or truncate, sometimes slightly eroded, the border of narrow cells with pitted walls occupying nearly the whole breadth of the leaf toward the base; hyaline cells rather short, not divided, normally without fibrils, their cell-membrane on the inner surface mostly resorbed in the cells of the apical part, the gaps decreasing in size downward and toward the side-region and passing into longitudinal membrane-pleats, on the outer surface resorbed only in the cells of the immediate apex: branches normally in fascicles of 5, 2 spreading, their cortical cells in a single layer, the retort-cells with inconspicuous necks: branch-leaves undulate when dry with spreading tips, narrowly lanceolate, involute toward the toothed apex, the border entire, of 2-4 rows of very narrow cells: hyaline cells fibrillose, narrowly linear-rhomboidal, in the basal portion 10-12 times as long as wide, shorter above to 6-7 times, on the inner surface with numerous large rounded pores in the angles and near the commissures, 4-7 per cell, on the outer surface with end-pores throughout, in the apical portion with small ringed pores also in the angles and near the commissures, accordingly 2-6 per cell: chlorophyll-cells triangular in section with the base of the triangle exposed on the outer surface of the leaf, its apex reaching the inner surface or slightly included; hyaline cells scarcely convex on the outer surface, slightly so on the inner, up to one fourth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, smaller than the normal branch-leaves, ovate with a sharp involute point, the hyaline cells shorter and wider. Fruiting branches erect; perichaetial leaves large, ovate, at the apex abruptly pointed with an involute often rent point, composed mostly of uniform narrow cells, the hyaline cells if differentiated reduced and without fibrils, showing membrane-gaps on the inner surface: capsule brown: spores brown-yellow, 20-25 μ in diameter, granular-roughened.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: Labrador southward to Florida and Louisiana; Colorado; Washington to Alaska; also in South America, Europe, and Asia, and reported from Africa.

ILLUSTRATIONS: Braithw. Spagh. *pl. 24*; G. Roth, Eur. Torfm. *pl. 6, f. 6; pl. 7, f. 3; pl. 10, f. 3*.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 10; ed. 2. 12; Eaton & Faxon, Spagh. Bor. Am. Exs. 104-109; Macoun, Can. Musci 9, 529.

Sphagnum recurvum tenue H. Klinggr. Schr. Phys.-ök. Ges. Königsb. 13: 5. 1872. (*S. recurvum parvifolium* Sendtn.; Warnst. Flora 66: 374. 1883; *S. parvifolium* Warnst. Bot. Centr. 82: 67. 1900.) Smaller. Branch-leaves hardly undulate because of reduced size. Greenland; Newfoundland southward to Pennsylvania; Michigan; Minnesota; Nebraska; Montana; Idaho; Washington to Alaska; also in Europe and Asia. ILLUSTRATION: G. Roth, Eur. Torfm. *pl. 7, f. 2*. EXSICC.: Eaton & Faxon, Spagh. Bor. Am. Exs. 110, 111; Macoun, Can. Musci 528; Ren. & Card. Musci Am. Sept. Exs. 351.

18. *Sphagnum pulchrum* (Lindb.) Warnst. Bot.

Centr. 82: 42. 1900.

Sphagnum intermedium pulchrum Lindb.; Braithw. Spagh. 81. 1880.

Plants normally robust, generally strongly tinged brown or purplish-brown. Wood-cylinder yellow-brown; cortical cells differentiated, in 2-3 layers, of varying size, the outer

cells quadrilateral, longer than wide, without fibrils or pores: stem-leaves small, triangular, strongly concave, abruptly involute-pointed at the apex, the border narrow at the apex, broadening rapidly below until filling nearly all of the leaf-breadth toward the base, the walls of its cells strongly pitted; hyaline cells short but narrow, not divided, fibrils rarely present in the apical part of the leaf, the membrane on the inner surface largely resorbed in the cells of the central and apical parts, the gaps decreasing in size toward the sides and base, or passing in the side-regions to longitudinal membrane-pleats, on the outer surface entire: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, the retort-cells large with a conspicuous neck: branch-leaves somewhat undulate when dry, commonly five-ranked when moist, or slightly subsecund, ovate, very concave, abruptly contracted to a cuspidate involute toothed apex; border entire, of 4-6 rows of narrow cells; hyaline cells fibrillose, narrowly linear-rhomboidal, in the basal portion 10-12 times as long as wide, shorter above to 5-6 times, the pores on the inner surface round with faint contours in the corners of cells, 3-6 per cell, on the outer surface with small ringed pores in the corners of the cells and along the commissures, most numerous near the apex of the leaf, 2-5 per cell: chlorophyll-cells in section triangular with the base exposed on the outer surface, the apex of the triangle frequently reaching only half the distance to the inner surface of the leaf or even less; hyaline cells hardly convex on the outer surface, on the inner one sixth to one fifth of the diameter of the cell.

Dioicous. Fruiting branches erect; perichaetial leaves deeply pigmented brown, ovate to obovate with an involute-pointed apex not infrequently rent, and a strong border of narrow cells with pitted walls, stronger in the apical half, the rest of the leaf with both kinds of cells, the hyaline ones narrow without fibrils or divisions, the membrane intact on the outer surface, with larger or smaller gaps on the inner surface in the cells of the apical part: capsule brown: spores brown-yellow, 25-28 μ in diameter, slightly granular-roughened.

TYPE LOCALITY: Sweden.

DISTRIBUTION: Labrador to New Jersey; also in northern Europe.

ILLUSTRATIONS: Braithw. Sphag. pl. 25, f. γ ; G. Roth, Eur. Torfm. pl. 2, f. 10.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 102, 103; Macoun, Can. Musci 530; Ren. & Card. Musci Am. Sept. Exs. 150, 352.

19. *Sphagnum balticum* Russow; C. Jens. Fests. Bot.

For. Kjöb. 100. 1890.

Sphagnum recurvum balticum Russow, Sitz.-ber. Nat.-Ges. Dorpat 9: 111. 1890.

Plants rather small and delicate, generally yellowish or strongly tinged with brown. Wood-cylinder yellow-green; cortical cells of the stem differentiated, in 2-3 layers, irregular in size and shape with relatively thick walls, the outer cells quadrilateral, generally longer than wide, without fibrils or pores: stem-leaves rather small, triangular-lingulate to oval, as wide as or wider than long, obtuse at the apex and very slightly lacerate, the border broad, very broad toward the base, the walls of its cells pitted; hyaline cells narrow, shorter in the apical part, not divided, with fibrils or stumps of fibrils in the cells of the apical part, the membrane resorbed on the inner surface in the cells of the apical part and downward in the center of the leaf, on the outer surface with small pores near the commissures in the apical cells: branches in fascicles of 3 or 4, 2 spreading, their cortical cells in a single layer, the retort-cells of good size with fairly conspicuous necks, sometimes a second cell above the first: branch-leaves hardly or slightly undulate, ovate-lanceolate, sometimes slightly subsecund, abruptly contracted to the involute toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 10-14 times as long as wide at the base, shorter above to 6-8 times, on the inner surface with pores in the ends and corners of the cells, 3 or 4 per cell, on the outer surface with similar ringed pores and also smaller pores along the commissures, up to 7-8 per cell: chlorophyll-cells in section triangular with the base exposed on the outer surface, the apex of the triangle rarely reaching the inner surface of the leaf, the lumen triangular-ovate, hyaline cells slightly convex on the inner surface, one sixth to one fifth of the diameter of the cell.

Dioicous.

TYPE LOCALITY: Livonia, Russia.

DISTRIBUTION: Greenland, Alaska, also in northern Europe and reported from Asia.

ILLUSTRATION: G. Roth, Eur. Torfm. pl. 7, f. 1.

20. *Sphagnum tenellum* Pers.; Brid. Musc. Recent. 2¹: 223. 1798.

Sphagnum molluscum Bruch, Flora 8: 635. 1825.

Plants very small and delicate, yellowish-green or more or less tinged with brown. Wood-cylinder yellowish-green; cortical cells of the stem in 2-3 layers, large with thin walls, the outer cells quadrilateral, longer than wide, without fibrils or pores: stem-leaves relatively large, lingulate, concave, ending in an abruptly involute tip, the border narrow, somewhat broadened below, the walls of its cells pitted; hyaline cells narrow below, broader near the apex (twice as long as wide), not divided, fibrillose to the base of the leaf or nearly so, on the inner surface the cells in the apex or near the outer margin showing large membrane-gaps, others with occasional pores or gaps in the ends or corners, on the outer surface mostly small ringed pores in the ends of fibrillose cells in the apical part, also in the side-corners: branches in fascicles of 3-5, 1-3 spreading, their cortical cells in a single layer, the retort-cells very large with long necks, commonly a second one above the first: branch-leaves loosely spreading, sometimes more or less subsecund, very small, ovate, strongly concave, involute in the upper part, the apex toothed, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose 6-8 times as long as wide at the base, shorter above to 2-3 times in the apex, on the inner surface with large and obscurely defined pores in the ends or corners of the cells, not more than 3 per cell, on the outer surface with small round strongly ringed pores in the ends or corners, not more than 3 per cell: chlorophyl-cells in section broadly triangular with a bulging convex base exposed on the outer surface, the apex sometimes exposed on the inner surface of the leaf, more commonly included; hyaline cells strongly convex on the inner surface, up to one half of the diameter of the cell or rather more.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves pigmented yellow or brown, otherwise hardly differentiated from normal branch-leaves. Fruiting branches erect, short and small; perichaetial leaves large, ovate with an acute apex, strongly concave, composed of both kinds of cells, the hyaline cells often fibrillose, the non-fibrillose hyaline cells of the apical part showing round or elongate membrane-gaps on the inner surface: capsule brown: spores greenish-yellow, 24-30 μ in diameter, smooth.

TYPE LOCALITY: Harz Mountains, Germany.

DISTRIBUTION: Labrador to New Jersey; Vancouver Island to Alaska; also in Europe and Asia.

ILLUSTRATIONS: Schimp. Mém. Sphag. pl. 21; Schimp. Versuch Torfm. pl. 21; Braithw. Sphag. pl. 6; G. Roth, Eur. Torfm. pl. 5, f. 6.

EXSICC.: Sull. & Lesq. Musci Bor. Am. ed. 2. 4; Eaton & Faxon, Sphag. Bor. Am. Exs. 113, 114; Macoun, Can. Musci 14; Ren. & Card. Musci Am. Sept. Exs. 142.

21. *Sphagnum cuspidatum* Ehrh.; Hoffm. Deuts. Fl. 2: 22. 1796.

? *Sphagnum gracile* Michx. Fl. Bor. Am. 2: 285. 1803.

Sphagnum virginianum Warnst. Hedwigia 39: 101. 1900.

Sphagnum ruppianense Warnst. Hedwigia 47: 115. 1908.

Sphagnum Faxonii Warnst. Hedwigia 47: 117. 1908.

Plants delicate or fairly robust, often very elongate or plumose, green or more commonly yellowish. Wood-cylinder yellow-green; cortical cells of the stem differentiated, in 2-3 layers, rather large and thin-walled, the outer cells quadrilateral, sometimes as wide as long, without fibrils or pores: stem-leaves small, triangular-ovate, strongly concave, slightly toothed but not lacerate at the apex; the border strong, considerably broadened below, its cell-walls pitted; hyaline cells narrow, short above, not divided, with or without fibrils in the apical part of the leaf, the membrane resorbed on the inner surface in the apical cells, the gaps decreasing in size downward and laterally, the membrane on the outer surface entire except occasional small end-pores: branches mostly in fascicles of 4, 2 spreading, the others drooping more or less, not closely applied to and concealing the stem, their cortical cells in a single layer, the retort-cells of good size with inconspicuous necks, often a second one above the first: branch-leaves slightly or not at all undulate when dry, long-lanceolate, involute, the apex toothed, the border normally entire, of 2-4 rows of narrow cells; hyaline cells fibrillose, narrowly linear-rhomboidal, in the basal portion 10-14 times as long as wide, shorter above to 5-6 times, on the inner surface the pores large or small, mostly in the ends or corners of the cells, 2-6 per cell, on the outer surface with small strongly ringed pores in the ends and corners of the cells, 2-5 per cell: chlorophyl-cells trapezoidal in section with broader exposure on the outer surface, the lumen triangular; hyaline cells slightly convex on the inner surface, one eighth to one sixth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, slightly smaller than the normal branch-leaves, relatively broader and with broader areolation, near the base the fibril-branches weakened or absent, the pores in the upper part small and numerous. Fruiting branches erect, sometimes very elongate, perichaetial leaves broad-ovate, broadly obtuse and entire at the apex, both kinds of cells present only in the central portion where the hyaline cells are narrow and inconspicuous, without fibrils, with membrane-gaps on the inner surface; capsule brown; spores brown-yellow, 24–28 μ in diameter, strongly granular-roughened.

TYPE LOCALITY: Europe.

DISTRIBUTION: Newfoundland to Georgia; also in Europe and Asia.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 32, f. 2B; Braithw. Sphag. pl. 26; G. Roth, Eur. Torfm. pl. 6, f. 1, 2, 3; pl. 10, f. 2.

EXSICC.: Aust. Musci App. 36; Sull. & Lesq. Musci Bor. Am. ed. 2, 10; Eaton & Faxon, Sphag. Bor. Am. Exs. 92–96; Macoun, Can. Musci 7, 602; Ren. & Card. Musci Am. Sept. Exs. 205.

Sphagnum cuspidatum Torreyi (Sull.) Braithw. Mo. Mic. Jour. 13: 64. 1875. (*S. Torreyanum* Sull. Mem. Am. Acad. II. 4: 174. 1849; *S. cuspidatum miquelonense* Card. Bull. Soc. Bot. Belg. 26: 56. 1887; *S. Kearneyi* Warnst. Hedwigia 39: 102. 1900.) More robust, larger in all its parts, the long lanceolate branch-leaves more or less undulate when dry, their chlorophyll-cells in section tending to be triangular instead of trapezoidal in the basal part of the leaf. Newfoundland to Virginia; also in Europe. ILLUSTRATIONS: Braithw. Sphag. pl. 27, f. c; G. Roth, Eur. Torfm. pl. 2, f. 4. EXSICC.: Sull. & Lesq. Musci Bor. Am. 9; ed. 2, 11; Eaton & Faxon, Sphag. Bor. Am. Exs. 88–91, 97, 98.

Sphagnum cuspidatum serrulatum Schlieph. Irmischia 2: 67. 1882. (*S. trinittense* C. Müll. Syn. 1: 102. 1848; *S. laxifolium serrulatum* Schlieph. Verh. Zool.-Bot. Ges. Wien 15: 397. 1865; *S. serratum* Aust. Bull. Torrey Club 6: 145. 1877; *S. Helleri* Warnst. Allg. Bot. Zeits. 11: 100. 1905.) Branch-leaves serrulate on the margin by the projecting ends of the narrow border-cells. Maine to Florida and Louisiana; Bermuda; Porto Rico; also in South America and reported from Europe. EXSICC.: Drummond, Musci Am. 19; Aust. Musci App. Suppl. 453; Eaton & Faxon, Sphag. Bor. Am. Exs. 99 (in part).

22. *Sphagnum Fitzgeraldi* Ren.; Lesq. & James, Man. 23. 1884.

Sphagnum Mohrianum Warnst. Hedwigia 31: 179. 1892.

Plants very small and delicate, whitish. Wood-cylinder light-green; cortical cells of the stem well differentiated, in 2–3 layers, large with thin walls, the outer cells elongate-quadrilateral, without pores or fibrils: stem-leaves large, hemi-isophyllous, ovate, rounded at the apex and very concave, the border very narrow (2–3 rows of cells), entire except as slightly serrulate near the apex; hyaline cells narrow, especially toward the base of the leaf, frequently divided, especially in the apical part, fibrillose throughout, on the inner surface with pores in the ends of the cells, rarely also in the side-corners, on the outer surface likewise, but pores in side-corners more frequent: branches in fascicles of 2 or 3, very lax and drooping, their cortical cells in a single layer, the retort-cells of good size with inconspicuous necks: branch-leaves not undulate, loosely spreading, ovate to oblong or nearly quadrate, with a broad truncate five-toothed apex, the border of 2–3 rows of narrow cells, serrulate by the projecting cell-ends; hyaline cells fibrillose, narrowly linear-rhomboidal, 10–12 times as long as wide below, toward the apex shorter to 6–8 times, on the inner surface with pores in the ends and corners of the cells, 3–4 per cell in the apical part of the leaf, further down with but one or two end-pores, on the outer surface similar, but the pores in the apical part very small and strongly ringed: chlorophyll-cells trapezoidal in section, more broadly exposed on the outer surface, the hyaline cells slightly convex on the outer surface, one sixth to one fifth of the diameter of the cell, more strongly so on the inner surface, one fourth to one third of the diameter.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, considerably smaller than normal branch-leaves, short, nearly orbicular, the areolation correspondingly shorter. Fruiting branches erect to horizontal; perichaetial leaves ovate, abruptly involute at the apex which is sometimes rent, with both kinds of cells throughout except in the immediate apex and narrow border which are composed of uniform narrow cells, the hyaline cells frequently fibrillose in part of the leaf, sometimes divided, on the inner surface with few membrane-gaps in the ends of the cells near the apex: capsule small, brown, with large operculum: spores yellow, 35–40 μ in diameter, coarsely roughened.

TYPE LOCALITY: Florida.

DISTRIBUTION: North Carolina, Georgia, Florida, and Alabama.

ILLUSTRATION: Verh. Bot. Ver. Prov. Brand. 32: pl. 1, f. 54–58; pl. 2, f. w.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 112.

23. *Sphagnum Dusenii* C. Jens.; Russow, Sitz.-ber. Nat.-Ges.
Dorpat 9: 107. 1890.

Plants rarely delicate, more commonly large and robust, more or less tinged with yellow-brown or brown. Wood-cylinder yellowish-green; cortical cells of the stem differentiated in 2-3 layers, not very large, with moderately thick walls, the outer cells elongate-quadrilateral to hexagonal, without fibrils or pores; stem-leaves rather small, lingulate-triangular, concave, rounded at the apex, the border very broad and strong, increasing greatly in breadth toward the base, the walls of its cells slightly pitted; hyaline cells narrow, broader in the apical portion and central strip to the base, not divided, without fibrils or rarely with rudimentary fibrils in some of the apical cells, on the inner surface with large membrane-gaps, on the outer surface the membrane entire; branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, the retort-cells of fair size with inconspicuous necks, sometimes a second retort-cell above the first; branch-leaves sometimes slightly undulate, frequently more or less subsecund, ovate-lanceolate, strongly involute above, especially toward the toothed apex, the border entire, of 3-4 rows of narrow cells; hyaline cells fibrillose, narrowly linear-rhomboidal, 10-12 times as long as wide at the base, shorter above to 6-8 times, on the inner surface pores mostly lacking, sometimes present in the corners of the cells in the apical part of the leaf, on the outer surface with numerous large rounded pores between the cross-fibrils, their diameter averaging half the width of the hyaline cell or more, accordingly in a single row in each cell, besides these sometimes with smaller pores in the lateral corners, altogether 5-12 per cell; chlorophyll-cells mostly trapezoidal in section with broader exposure on the outer surface; hyaline cells slightly if at all convex on the outer surface, more so on the inner surface, where up to one sixth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, otherwise hardly differentiated from the normal branch-leaves. Fruiting branches erect; perichaetial leaves large, ovate-lingulate, with an abruptly involute point, with both kinds of cells in the upper middle portion, the hyaline cells here fibrillose, their membrane on the inner surface considerably resorbed, on the outer surface intact except for occasional minute end-pores in fibrillose cells; capsule brown; spores greenish-yellow, 25-30 μ in diameter, nearly or quite smooth.

TYPE LOCALITY: Europe.

DISTRIBUTION: Labrador to Connecticut and New York; Michigan; reported from Wisconsin; also in Europe and reported from Asia.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. pl. 2; G. Roth, Eur. Torfm. pl. 2, f. 6.

EXSICC.: Aust. Musci App. 31; Eaton & Faxon, Sphag. Bor. Am. Exs. 100, 101; Macoun, Can. Musci 8.

24. *Sphagnum mendocinum* Sull. & Lesq.; Sull. Ic. Musc.
Suppl. 12. 1874.

Plants rather delicate to fairly robust, yellowish-green or more or less tinged with brown. Wood-cylinder yellowish-green; cortical cells of the stem differentiated, in 1-2 layers, generally large with thin walls, the outer cells quadrilateral, generally longer than wide, without fibrils or pores; stem-leaves rather small, as wide as long, ovate-triangular, very concave, the border narrow, broadened below, the walls of its cells somewhat pitted; hyaline cells narrow, somewhat broader in the apical part, rarely divided, those of the apical portion with fibrils, on the inner surface with numerous rather small mostly round pores and membrane-gaps, in the apical part up to 8-10 in each cell, frequently in a double row along the commissures, on the outer surface the pores lacking except in the corners of the fibrillose apical cells; branches in fascicles of 5 or 6, in the latter case 3 spreading, their cortical cells in a single layer, the retort-cells of good size with conspicuous necks, rarely a second retort-cell above the first; branch-leaves slightly undulate with recurved tips, ovate-lanceolate, strongly involute toward the toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly linear-rhomboidal, 8-10 times as long as wide at the base, 6-8 times at the apex, on the inner surface with numerous pores, mostly small and round and arranged along the commissures, variably ringed, 5-15 per cell, on the outer surface with very numerous strongly ringed small elliptic pores along the commissures, 15-20 per cell except as reduced in number in the cells of the

central basal portion: chlorophyl-cells triangular in section with the base exposed on the outer surface, the apex just included on the inner surface or sometimes exposed here with a very thick wall, the lumen triangular; hyaline cells slightly convex on the outer surface, on the inner more so, one sixth to one fifth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, otherwise not greatly differentiated from the normal branch-leaves. Fruiting branches erect, elongate; perichaetial leaves large, ovate, abruptly involute-pointed to the entire obtuse apex, with both kinds of cells in the upper middle portion, the hyaline cells narrow, simulating the others, without fibrils, with traces of membrane-resorption on the inner surface; capsule of good size, brown; spores yellow, about $30\ \mu$ in diameter, very slightly roughened.

TYPE LOCALITY: Near Mendocino City, California.

DISTRIBUTION: Northern California and Idaho to British Columbia.

ILLUSTRATION: Sull. Ic. Musc. Suppl. *pl.* 3.

25. *Sphagnum subsecundum* Nees; Sturm, Deuts. Fl.

Crypt. 17: *pl.* 3. 1819.

- Sphagnum contortum* Schultz, Prodr. Fl. Starg. Suppl. 64. 1819.
Sphagnum Lescurii Sull. in A. Gray, Man. ed. 2. 611. 1856.
Sphagnum auriculatum Schimp. Mém. Sphaig. 80. 1857.
Sphagnum neglectum Angstr. Oefv. Sv. Vet.-Akad. Förh. 21: 201. 1864.
Sphagnum larinum Spruce; Lindb. Acta Soc. Sci. Fenn. 10: 263. 1872.
Sphagnum platyphyllum Sull.; Warnst. Flora 67: 481. 1884.
Sphagnum rufescens Limpr.; Warnst. Hedwigia 27: 267. 1888.
Sphagnum crassicaudum Warnst. Bot. Centr. 40: 165. 1889.
Sphagnum obesum Wilson; Warnst. Bot. Gaz. 15: 247. 1890.
Sphagnum plicatum Warnst. Hedwigia 30: 169. 1891.
Sphagnum dasyphyllum Warnst. Hedwigia 31: 176. 1892.
Sphagnum orlandense Warnst. Hedwigia 31: 177. 1892.
Sphagnum mobilense Warnst. Hedwigia 31: 180. 1892.
Sphagnum inundatum Russow, Arch. Nat. Dorpat 10: 405. 1894.
Sphagnum Gravelii Russow, Arch. Nat. Dorpat 10: 423. 1894.
Sphagnum simile Warnst. Hedwigia 33: 326. 1894.
Sphagnum flavicans Warnst. Allg. Bot. Zeits. 1: 205. 1895.
Sphagnum Langloisi Warnst. Hedwigia 36: 166. 1897.
Sphagnum xerophilum Warnst. Hedwigia 36: 167. 1897.
Sphagnum aquatile Warnst. Verh. Bot. Ver. Prov. Brand. 41: 31. 1899.
Sphagnum lurgidulum Warnst. Krypt.-fl. Brand. 1: 462. 1903.
Sphagnum bavaricum Warnst. Hedwigia 47: 84. 1907.
Sphagnum missouricum Warnst. & Card.; Warnst. Hedwigia 47: 93. 1907.
Sphagnum Bushii Warnst. & Card.; Warnst. Hedwigia 47: 94. 1907.
Sphagnum Franconiae Warnst. in Engler, Pflanzenreich Sphag. 310. 1911.
Sphagnum Louisianae Warnst. in Engler, Pflanzenreich Sphag. 322. 1911.
Sphagnum cochlearifolium Warnst. in Engler, Pflanzenreich Sphag. 323. 1911.
Sphagnum bostonense Warnst. in Engler, Pflanzenreich Sphag. 348. 1911.
Sphagnum novo-fundlandicum Warnst. in Engler, Pflanzenreich Sphag. 351. 1911.
Sphagnum fluviatile Warnst. in Engler, Pflanzenreich Sphag. 351. 1911.
Sphagnum pseudocarrosus Warnst. in Engler, Pflanzenreich Sphag. 353. 1911.
Sphagnum cordifolium Warnst. in Engler, Pflanzenreich Sphag. 357. 1911.
Sphagnum Nicholii Warnst. in Engler, Pflanzenreich Sphag. 384. 1911.
Sphagnum Smithianum Warnst. in Engler, Pflanzenreich Sphag. 397. 1911.
Sphagnum Bakeri Warnst. in Engler, Pflanzenreich Sphag. 414. 1911.
Sphagnum validum Warnst. in Engler, Pflanzenreich Sphag. 417. 1911.

Plants small and delicate to robust, very variable, green or variously tinged with shades of purplish-brown. Wood-cylinder yellowish-green to brown; cortical cells of the stem in 1-3 layers, larger or smaller, the walls thin, the outer cells quadrilateral, often as wide as long or nearly so, without fibrils or pores; stem-leaves normally small, but varying through all degrees to nearly isophyllous, triangular-lingulate or lingulate to ovate, concave, rounded at the apex, the border narrow, slightly wider below; hyaline cells narrowly rhomboidal, shorter and wider near the apex, rarely divided, the membrane on the inner surface with irregular gaps in the cells of the immediate apex, below with longitudinal membrane-pleats, on the outer surface with membrane-pleats, fibrils lacking, the hemi-isophyllous forms approaching in all degrees the conditions of the branch-leaves both as to fibrils and pores; branches mostly in fascicles of 2, 6, 2 or 3 spreading, their cortical cells in a single layer, without fibrils, the retort-cells with inconspicuous necks, generally a second retort-cell above the first; branch-leaves subsecund to regularly imbricate, not undulate when dry, normally ovate, varying on the one

hand to elongate-lanceolate, on the other to short-elliptic or nearly orbicular, generally involute to the toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells with fibrils, narrowly rhomboidal, 8-10 times as long as wide at the base, shorter above to 4-5 times, averaging longer or shorter with variation in the shape of the leaf, on the inner surface with a few small round pores in the angles of the cells or somewhat more numerous along the commissures, on the outer surface normally in rows like strings of beads along the commissures, strongly ringed, sometimes vestibuled or with pseudopores alone, round or elliptic, 10-20 per cell, often more, sometimes on the other hand much reduced: chlorophyl-cells in section truncately elliptic, equally exposed on both surfaces, varying to trapezoidal with broader exposure on the outer surface or almost included on the inner surface, the lumen lenticular, central or nearly so; walls of hyaline cells very slightly convex, rather more so on the inner surface, where not more than one eighth of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, as large as the normal branch-leaves, the cells of the basal part with the fibrils reduced or nearly obsolete. Fruiting branches short, erect; perichaetial leaves ovate, abruptly involute-pointed, sometimes eroded at the apex, with both kinds of cells in the upper central portion, the hyaline cells usually not fibrillose but sometimes with fibrils or divisions, on the inner surface with small round gaps in the upper ends of the cells: capsule dark-brown: spores brown-yellow, 25-28 μ in diameter, finely granular-roughened.

TYPE LOCALITY: Germany.

DISTRIBUTION: Greenland; Labrador to Florida, Louisiana, and Mexico; California to Washington; also in Europe and Asia and regarded as cosmopolitan.

ILLUSTRATIONS: Sturm, Deuts. Fl. Crypt. 17: pl. 3; Schimp. Mém. Sphaig. pl. 22-24; Schimp. Versuch Torfm. pl. 22-24; Braithw. Sphag. pl. 7-10; G. Roth, Eur. Torfm. pl. 7, 9, 10, 11, *passim*.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 127-147; Macoun, Can. Musci 13; Ren. & Card. Musci Am. Sept. Exs. 253.

26. *Sphagnum Pylaesii* Brid. Bryol. Univ. 1: 749. 1827.

Sphagnum sedoides Brid. Bryol. Univ. 1: 750. 1827.

Plants small and delicate, occasionally very elongate, greenish or nearly always strongly tinged with purple or brown, often nearly black. Wood-cylinder yellowish-green to more or less brownish; cortical cells of the stem well differentiated, in 1-2 layers, the walls of medium thickness, the outer cells narrowly quadrilateral, without fibrils or pores: stem-leaves large, isophyllous, ovate to obovate, concave, rounded at the apex and often somewhat eroded-lacerate, the border of 2-3 rows of narrow cells; hyaline cells narrowly rhomboidal throughout, fibrillose, the pores as in branch-leaves: branches none, single, or in fascicles of 2 or 3, in the last case one or two stronger and spreading, their cortical cells in a single layer, the retort-cells but slightly differentiated, with inconspicuous necks: branch-leaves imbricate when dry, sometimes slightly subsecund, much smaller than the stem-leaves, broadly ovate, sometimes as wide as or wider than long, strongly concave, with a rounded apex, the border elusive, of 1-2 rows of narrow cells, sometimes hyaline by resorption of the membrane on the inner surface, not however toothed; hyaline cells fibrillose, linear-rhomboidal, 8-10 times as long as wide at the base, much shorter above to 3-4 times in the apex, on the inner surface with pores in the ends of the cells and in the apical part also in the side-corners, here then up to 4 per cell, on the outer surface with irregular gaps in the apical part of the leaf, passing into longitudinal membrane-pleats below, or with occasional pores in the ends of the cells: chlorophyl-cells nearly rectangular in section, exposed equally on either surface, or trapezoidal with slightly broader exposure on the inner surface, the lumen broader toward the inner surface; hyaline cells with very slight convexity on the outer surface, not more than one eighth of the diameter of the cell.

Dioicous. Antheridia in terminal catkins on spreading branches; antheridial leaves hardly differentiated from the normal branch-leaves. Fruiting branches horizontal, hardly differentiated from the normal branches; perichaetial leaves somewhat larger, not sheathing the slender pseudopodium, the uppermost lanceolate-ovate with a blunt toothed apex, with both kinds of cells throughout, the hyaline ones everywhere fibrillose: capsule very small, slightly exserted on a slender pseudopodium, when deoperculate shallowly hemispheric, thin-

walled, without pseudostomata: spores yellow, 30–40 μ in diameter, very strongly granular-roughened.

TYPE LOCALITY: Newfoundland.

DISTRIBUTION: Labrador to South Carolina; also in France.

ILLUSTRATIONS: Sull. Ic. Musc. *pl.* 6; Suppl. *pl.* 6; Braithw. Sphag. *pl.* 28; G. Roth, Eur. Torfm. *pl.* 5, *f.* 5.

EXSICC.: Sull. Musci Allegh. 208; Sull. & Lesq. Musci Bor. Am. 3, 4; ed. 2. 5–7; Eaton & Faxon, Sphag. Bor. Am. Exs. 123–126; Ren. & Card. Musci Am. Sept. Exs. 143.

27. *Sphagnum cyclophyllum* Sull. & Lesq.; Sull. in A. Gray, Man. ed. 2. 611. 1856.

Sphagnum microcarpum Warnst. Hedwigia 30: 170. 1891.

Sphagnum Alabamae Warnst. Hedwigia 47: 94. 1907.

Plants low, erect or procumbent, green or more or less tinged with brown. Wood-cylinder generally brown; cortical cells of the stem in 1–2 layers, very large and thin-walled, the outer cells quadrilateral, generally longer than wide, often with a pore in the upper end; stem-leaves isophyllous, as branches are usually lacking, or if present mostly single, thick, ascending: leaves oval to ovate, faintly toothed across the rounded apex, the border weak, of 1–2 rows of narrow cells; hyaline cells fibrillose throughout, 10–12 times as long as wide in the central portion, shorter toward the base and apex to 5–6 times, on the inner surface mostly with a few pores in the ends and corners of the cells, 2–5 per cell, on the outer surface with very minute round pores near the commissures, up to 20 or more per cell, sometimes reduced in number or larger in size: chlorophyl-cells in section mostly trapezoidal with broader exposure on the inner surface, the lumen triangular, the walls thin; hyaline cells not convex on the inner surface, very slightly so on the outer, not more than one eighth to one sixth of the diameter of the cell.

Diocious. Fruiting branches short; perichaetial leaves large, ovate, with both kinds of cells throughout, the hyaline cells all fibrillose: capsule rather small, dark-brown; pseudopodium short; wall of the capsule with or without pseudostomata: spores yellow, 25–35 μ in diameter, granular-roughened.

TYPE LOCALITY: Alabama.

DISTRIBUTION: New Jersey to Florida, Alabama, and Louisiana; also in Brazil.

ILLUSTRATIONS: Sull. Ic. Musc. *pl.* 6; Suppl. *pl.* 7; Hedwigia 30: *pl.* 24, *f.* oo.

EXSICC.: Drummond, So. Mosses 17; Aust. Musci App. 25; Sull. & Lesq. Musci Bor. Am. 5; ed. 2. 8; Eaton & Faxon, Sphag. Bor. Am. Exs. 148.

28. *Sphagnum macrophyllum* Bernh.; Brid. Bryol. Univ. 1: 10. 1826.

Sphagnum cribrorum Lindb. Hvitm. 74. 1882.

Sphagnum floridanum Card. Bull. Soc. Bot. Belg. 26¹: 60. 1887.

Plants more or less robust, brownish when dry or silvery-white. Wood-cylinder very hard, yellowish-green to brownish; cortical cells of the stem in 2–3 layers, rather large with thin walls, the outer cells quadrilateral, considerably longer than wide, without fibrils or pores: stem-leaves small, lingulate-triangular, slightly concave, rounded at the apex, the border indistinct, narrow; hyaline cells rhomboidal, slightly longer and narrower toward the sides and base, without fibrils, rarely divided, the membrane on the outer surface intact with longitudinal membrane-pleats in the apical and central cells, on the inner surface with rather large round pores, if single, central, if more than one, in a row, 1–4 per cell: branches most commonly in fascicles of 2, both spreading, one frequently much stronger, generally both deflexed, their cortical cells in 1–3 layers, homogeneous, their mass abruptly thickened just above the leaf-insertion, but without retort-cells or such if present much reduced and inconspicuous, without fibrils or pores: branch-leaves aggregated in a tuft, lax, long linear-lanceolate, involute-tubulose toward the toothed apex, the border entire, of 2–3 rows of narrow cells; hyaline cells without fibrils, linear-sinuate, very long and narrow, 15–30 or more times as long as wide, on the inner surface mostly without pores, on the outer surface with larger or smaller round pores in a single row midway of the cell, or the row doubled in the central part or throughout, rarely 3 rows in the central part, 5–60 and upwards per cell: chlorophyl-cells rectangular in section, exposed equally or nearly so on both surfaces, the lumen elliptic; walls

of the hyaline cells not convex on the inner surface, slightly so on the outer, one sixth to one fifth of the diameter of the cell.

Dioicous. Fruiting branches spreading or erect; perichaetial leaves large, ovate, concave, toothed across the blunt apex, bordered by 3-4 rows of narrow cells, otherwise of both kinds of cells throughout, the hyaline ones without fibrils, their membrane on the outer surface with round pores, usually one in either end or in the apical region several in a single row, on the inner surface with a few similar end-pores, almost exclusively in the cells of the basal part: capsule dark-brown: spores yellow, 25-30 μ in diameter, slightly granular-roughened.

TYPE LOCALITY: Near Philadelphia, Pennsylvania.

DISTRIBUTION: Maine to Florida and Louisiana.

ILLUSTRATIONS: Sull. Ic. Musc. *pl. 1*; Braithw. Sphag. *pl. 29*.

EXSICC.: Drummond, So. Mosses *18*; Sull. & Lesq. Musci Bor. Am. *1*; Eaton & Faxon, Sphag. Bor. Am. Exs. *76-78*; Ren. & Card. Musci Am. Sept. Exs. *152*.

29. *Sphagnum fimbriatum* Wilson: Hook. f. & Wils., in Hook. f.

Fl. Antarct. 398. 1846.

Sphagnum microphyllum Warnst. Hedwigia *30*: 172. 1891.

Sphagnum Bolanderi Warnst. Hedwigia *30*: 173. 1891.

Plants usually very slender and delicate, green or sometimes yellowish. Wood-cylinder green; cortical cells of the stem in 1-3 layers, large with thin walls, without fibrils, the outer cells quadrilateral to irregularly pentagonal or hexagonal, generally longer than broad, with a single large rounded pore in the upper end: stem-leaves large, short-spatulate, often broader than long, concave, clasping the stem, the border lacerate at the apex and sides by resorption of the cell-membrane; hyaline cells rhomboidal throughout, 2-3 times as long as wide, divided once or more times especially in the side and apical regions, without fibrils, on the outer surface with the membrane completely resorbed, on the inner surface with the membrane similarly nearly all resorbed, the hyaline cells much reduced in the lower side-regions, where the walls of the chlorophyl-cells are pitted: branches slender, normally in fascicles of 5, 2 or 3 spreading, their cortical cells in a single layer, without fibrils, the retort-cells elongate and slender with inconspicuous necks: branch-leaves imbricate, small, ovate, strongly concave, involute above to a sharp toothed apex, the border entire, of 2-3 rows of narrow cells, the hyaline cells fibrillose, narrowly rhomboidal, 8-12 times as long as wide, shortened toward the apex to 4-5 times, on the inner surface with numerous large rounded pores whose diameter is nearly equal to the width of the cell, 4-6 per cell, reduced or lacking in the cells of the middle basal portion, on the outer surface the pores more numerous, smaller, elliptic, near the commissures, strongly ringed in the upper half of the leaf, gradually increasing in size toward the base of the leaf where they are nearly or quite of the cell-width, 5-8 per cell: chlorophyl-cells trapezoidal in section with slightly broader exposure on the inner surface, the lumen of nearly the same shape; walls of the hyaline cells convex on both surfaces, more strongly so on the outer one where up to one third of the diameter of the cell, on the inner surface up to one fifth of the diameter.

Monoicous. Antheridia in catkins on spreading branches; antheridial leaves imbricate, brown, broadly ovate, the areolation shorter than in the normal branch-leaves, the hyaline cells of the basal fourth without fibrils or pores. Fruiting branches short, erect; perichaetial leaves lingulate-spatulate, concave, the apex involute-apiculate, broadly truncate when flattened out, sometimes slightly lacerate, mostly of uniform elongate cells with pitted walls, the upper perichaetial leaves which are largest showing a central portion with both kinds of cells, the hyaline cells commonly divided, without fibrils or pores: capsule dark-brown; spores greenish-yellow, 18-20 μ in diameter, smooth or slightly granular-roughened.

TYPE LOCALITY: South America.

DISTRIBUTION: Greenland and Labrador to Maryland; Minnesota; Wyoming; California; Alaska; also in South America, Europe, and Asia.

ILLUSTRATIONS: Wilson, Bryol. Brit. *pl. 60*; Schimp. Mém. Sphaig. *pl. 15*; Schimp. Versuch Torfm. *pl. 15*; Braithw. Sphag. *pl. 16*; G. Roth, Eur. Torfm. *pl. 4, f. 1, 2*.

EXSICC.: Sull. & Lesq. Musci Bor. Am. ed. *2*. *15*; Eaton & Faxon, Sphag. Bor. Am. Exs. *11-16*.

30. *Sphagnum Girgensohnii* Russow, Beitr. Torfm. 46. 1865.

Sphagnum strictum Lindb. Acta Soc. Sci. Fenn. *10*: 263. 1872.

Sphagnum Mehneri Warnst. Hedwigia *47*: 113. 1908.

Plants sometimes short and compact, more commonly fairly robust, often very tall, green or sometimes slightly yellowish or brownish. Wood-cylinder green or yellowish or brownish;

cortical cells of the stem in 2-4 layers, large, thin-walled, without fibrils, the outer cells quadrilateral to irregularly pentagonal or hexagonal, mostly longer than broad, with a single large rounded pore in the upper end: stem-leaves large, short-lingulate, frequently as wide as long, slightly concave, lacerate at the broad apex, with a strong border of narrow cells at the sides, broadened toward the base where the walls of its cells are pitted; hyaline cells rhomboidal, 2-3 times as long as wide in the apical part, narrower below and at the sides, without fibrils except in hemi-isophyllous forms, not divided, the membrane on the inner surface showing in apical cells large membrane-gaps occupying nearly the whole of the cell, the gaps reduced in size downward and passing into longitudinal membrane-pleats, on the outer surface the gaps more generally distributed but smaller and more nearly round: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, without fibrils, the retort-cells well developed with conspicuous necks: branch-leaves imbricate, rarely squarrose, mostly small, ovate, involute above to the toothed apex; the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, near the base 6-10 times as long as wide, shortened toward the apex to 3-4 times, on the inner surface with very numerous large rounded pores, 3-5 per cell, only in the central basal portion reduced or lacking, on the outer surface the pores very numerous, elliptic, along the commissures, only in the middle basal part nearly of cell-width, 4-12 per cell: chlorophyll-cells trapezoidal in section with broader exposure on the inner surface to triangular, the lumen triangular; hyaline cells slightly or not at all convex on the inner surface, decidedly so on the outer, one fifth to one third of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, broader and shorter than the normal branch-leaves, the hyaline cells of the basal part lacking fibrils and pores. Fruiting branches erect; perichaetial leaves ovate-lingulate, the abruptly involute apex sometimes slightly lacerate, the whole leaf composed of uniform narrow cells: capsule dark-brown: spores brown-yellow, 20-25 μ in diameter, strongly granular-roughened.

TYPE LOCALITY: Livonia, Russia.

DISTRIBUTION: Greenland and Labrador to New Jersey; Pennsylvania; West Virginia; Ohio; Minnesota; Oregon to Alaska; also in Europe and Asia.

ILLUSTRATIONS: Russow, Beitr. Torfm. f. 12, 15, 18, 19, 21, 43-45, 61; Sull. Ic. Musc. Suppl. pl. 5; Braithw. Sphag. pl. 17; G. Roth, Eur. Torfm. pl. 4, f. 4, 5.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 1-10; Macoun, Can. Musci 6; Ren. & Card. Musci Am. Sept. Exs. 148.

31. *Sphagnum robustum* (Russow) Röll, Flora 69: 109. Mr 1886.

Sphagnum acutifolium robustum Russow, Beitr. Torfm. 39. 1865.

Sphagnum Russowii Warnst. Hedwigia 25: 225. D 1886.

Plants slender to fairly robust, green with more or less of reddish tinge. Wood-cylinder green, tinged reddish; cortical cells of the stem in 2-4 layers, large, thin-walled, without fibrils, the outer cells irregularly quadrilateral, generally much longer than broad, mostly with a single rather large rounded pore near the upper end: stem-leaves large, generally tinged with red, short lingulate-ovate, always longer than broad, somewhat concave, appressed to the stem, the border much broadened in the basal part where strongly pigmented, the walls of its cells pitted, the border lacking only at the immediate apex which may be slightly lacerate; hyaline cells rhomboidal, 2-3 times as long as wide in the apical part, longer and narrower at the base, rarely divided, without fibrils, on the inner surface the membrane nearly all resorbed, on the outer entire with longitudinal membrane-pleats: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, without fibrils, the retort-cells well developed with conspicuous necks: branch-leaves imbricate, small, ovate-lanceolate, involute above to a toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 10-12 times as long as wide toward the base, shorter toward the apex to 4-6 times, on the inner surface with large pores of nearly or quite the cell-width, 3-6 per cell, on the outer surface with numerous elliptic pores along the commissures, sometimes cell-wide in the basal part, 4-5 per cell: chlorophyll-cells triangular in section with the base exposed on the inner surface, the apex reaching the outer surface; hyaline cells very slightly convex on the inner surface, more so on the outer, up to one fourth of the diameter of the cell.

Dioicous or monoicous. Antheridia in catkins on spreading branches; antheridial leaves strongly pigmented red, somewhat shorter in relation to their width than the normal branch-

leaves, their hyaline cells in the basal third or half without fibrils or pores. Fruiting branches erect, short; perichaetial leaves lingulate, the apex abruptly involute-pointed, sometimes slightly lacerate-cleft, composed throughout or nearly so of uniform narrow cells without fibrils or pores: capsule brown: spores brown-yellow, 20–25 μ in diameter, strongly granular-roughened.

TYPE LOCALITY: Livonia, Russia.

DISTRIBUTION: Greenland and Labrador to Massachusetts and New York; Colorado; Montana; Idaho; reported from Washington; also in Europe and reported from Asia.

ILLUSTRATIONS: Russow, Beitr. Torfm. f. 41; G. Roth, Eur. Torfm. pl. 4, f. 6.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 17–22; Macoun, Can. Musci 603; Ren. & Card. Musci Am. Sept. Exs. 262, 263.

32. *Sphagnum fuscum* (Schimp.) H. Klinggr. Schr. Phys.-ök. Ges.

Königsb. 13: 4. 1872.

Sphagnum acutifolium fuscum Schimp, Mém. Sphaig. 64. 1857.

Sphagnum vancouveriense Warnst. Hedwigia 33: 309. 1894.

Sphagnum tenuifolium Warnst. Allg. Bot. Zeits. 1: 115. 1895.

Plants generally slender and delicate, compactly matted, sometimes fairly robust, usually brown, sometimes merely tinged with brown or even entirely green. Wood-cylinder brown; cortical cells of the stem in 2–4 layers, large, thin-walled, without fibrils, the outer cells quadrilateral to hexagonal, nearly as wide as long, without pores: stem-leaves medium-sized, linguulate, up to twice as long as wide, slightly concave, the border strong, much broadened near the base, its cells narrow with pitted walls; hyaline cells rhomboidal, 3–4 times as long as wide in the apical part, longer and narrower toward the base and sides, mostly once divided, usually without fibrils, on the inner surface the membrane nearly all resorbed, on the outer surface entire with longitudinal membrane-pleats: branches in fascicles of 3–5, 2 normally spreading, their cortical cells in a single layer without fibrils, the retort-cells well developed with conspicuous necks: branch-leaves regularly imbricate or somewhat spreading, small, narrowly lanceolate, involute toward the toothed apex, the border entire, of 2–3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 8–12 times as long as wide near the base, shorter above to 6–8 times, on the inner surface with pores in the ends, sometimes also in the side-corners, 2–4 per cell, on the outer surface with larger or smaller elliptic pores near the commissures in the apical part of the leaf, increasing in size toward the base, 3–8 per cell: chlorophyll-cells triangular or rarely trapezoidal in section with broader exposure on the inner surface, the lumen small, triangular; hyaline cells slightly if at all convex on the inner surface, strongly so on the outer, up to half the diameter of the cell near the base of the leaf, much less in the apical part.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves brown, smaller than the normal branch-leaves, broadly ovate, the hyaline cells of the basal half without fibrils or pores. Fruiting branches erect, short; perichaetial leaves ovate to ovate-lanceolate, obtuse or slightly acute at the apex, with both kinds of cells in the upper half or two thirds except in the immediate apex, the hyaline cells without fibrils or pores, often once divided, showing longitudinal membrane-pleats: capsule brown: spores yellow, 20–25 μ in diameter, smooth or nearly so.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador to Connecticut and New York; Michigan; Minnesota; Montana; Colorado; Washington northward to Alaska; also in Europe and reported from Asia.

ILLUSTRATIONS: Schimp, Mém. Sphaig. pl. 13, f. c; Schimp, Versuch Torfm. pl. 13, f. c; Braithw. Sphag. pl. 20, f. c; G. Roth, Eur. Torfm. pl. 8, f. 1.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 33–35; Macoun, Can. Musci 531, 532; Ren. & Card. Musci Am. Sept. Exs. 147.

33. *Sphagnum Warnstorffii* Russow, Sitz.-ber. Nat.-Ges.

Dorpat 8: 315. 1888.

Plants slender and delicate, green or more or less tinged with red. Wood-cylinder usually reddish; cortical cells of the stem in 2–4 layers, large, thin-walled, without fibrils, the outer cells irregularly quadrilateral, often as wide as long, without pores: stem-leaves of medium size, linguulate to linguulate-ovate, twice as long as broad, slightly concave, the border strong,

much broadened near the base; hyaline cells rhomboidal, 2-3 times as long as wide in the apical part, longer and narrower toward the base, mostly once divided, the fibrils generally lacking, on the inner surface the membrane mostly resorbed, on the outer surface with longitudinal membrane-pleats: branches in fascicles of 3-5, 2 spreading, their cortical cells in a single layer without fibrils, the retort-cells well developed with conspicuous necks: branch-leaves loosely spreading, often distinctly five-ranked, small, narrowly lanceolate, involute above to the toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 8-12 times as long as wide near the base, shorter above to 3-5 times at the apex, on the inner surface with pores in the ends of the cells, sometimes also in the side-corners, in the cells of the lower side-regions more numerous and larger, 2-6 per cell, on the outer surface in the upper one-half or two-thirds with very small strongly ringed or elliptic pores mostly near the commissures, below larger and less strongly ringed, 2-8 per cell: chlorophyl-cells in section triangular or more generally trapezoidal with broader exposure on the inner surface, the lumen of the same shape; hyaline cells slightly convex on the inner surface, much more so on the outer, up to one third of the diameter of the cell.

Dioicous. Antheridia in catkins on spreading branches; antheridial leaves strongly pigmented red, very short-ovate with an involute apex, fibrils and pores lacking in the hyaline cells of the basal one third to one half. Fruiting branches short, erect; perichaetial leaves long lanceolate-ovate, gradually tapering to a narrowly truncate or irregular apex, the cells uniform throughout or nearly so, their cell-walls pitted: capsule dark-brown: spores brown-yellow, 18-20 μ in diameter, finely papillose.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador to Connecticut and New York; Michigan; Minnesota; Colorado and northward in Rocky Mountains to Alaska; also in Europe and reported from Asia.

ILLUSTRATIONS: G. Roth, Eur. Torfm. pl. 7, f. 10; pl. 8, f. 7.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 23-28; Macoun, Can. Musci 572, 573; Ren. & Card. Musci Am. Sept. Exs. 260.

34. *Sphagnum capillaceum* (Weiss) Schrank, Baier.

Fl. 2: 435. 1789.

Sphagnum palustre capillaceum Weiss, Pl. Crypt. Gott. 265. 1770.

Sphagnum acutifolium Ehrh.; Brid. Jour. Bot. Schrad. 1800¹: 270. 1801.

Sphagnum Schimperii Röll, Flora 69: 39. 1886.

Sphagnum Schliephackeanum Röll, Flora 69: 43. 1886.

Plants generally short and compact, sometimes tall and slender or even fairly robust, green, generally more or less tinged with red. Wood-cylinder mostly reddish; cortical cells of the stem in 2-4 layers, large, thin-walled, without fibrils, the outer cells quadrilateral, longer than wide, without pores: stem-leaves large, mostly twice as long as wide or more, lingulate to triangular-ovate, strongly concave, the border strong, broadened toward the base, the walls of its cells strongly pitted, the apex of the leaf mostly involute-pointed, toothed as in the branch-leaves; hyaline cells rhomboidal, 4-5 times as long as wide in the apical part, narrower toward the sides and base, with traces of fibrils in the apical part of the leaf or throughout, often divided, the membrane in hemi-isophyllous forms approaching the condition of the branch-leaves, otherwise on the inner surface mostly resorbed in large membrane-gaps which decrease in size toward the base and sides of the leaf, on the outer surface entire: branches in fascicles of 3-5, 2 normally spreading, their cortical cells in a single layer, without fibrils, the retort-cells well differentiated with conspicuous necks: branch-leaves imbricate or slightly spreading, mostly small, lanceolate, involute above to the toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose throughout the leaf, narrowly rhomboidal, near the base 10-12 times as long as wide, shorter toward the apex to 6 times, on the inner surface with pores in the ends of the cells, in the lower side-regions with other large pores of nearly cell-width, altogether 2-5 per cell, on the outer surface with numerous elliptic pores along the commissures, all large, longer and less strongly ringed toward the base of the leaf, 5-12 per cell: chlorophyl-cells triangular to trapezoidal in section with broader exposure on the inner surface; hyaline cells slightly convex on the inner surface, strongly so on the outer, up to one-half of the diameter of the cell.

Frequently but not always monoicous. Antheridia in catkins on spreading branches; antheridial leaves strongly pigmented red, smaller than the normal branch-leaves, short-ovate, hardly longer than wide, abruptly involute-apiculate at the apex, the hyaline cells of the lower one third to one half without fibrils or pores. Fruiting branches erect; perichaetial leaves lanceolate-ovate, abruptly involute at the apex, the middle portion with both kinds of cells, the hyaline cells without fibrils or pores, sometimes divided and with longitudinal membrane-pleats: capsule brown: spores yellow, 20–25 μ in diameter, smooth or somewhat granular-roughened.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador to Virginia; Wisconsin; Minnesota; Colorado; Washington to Alaska; also in South America, Europe, and Asia.

ILLUSTRATIONS: Schimp. Mém. Sphaig. pl. 13, f. 1–6; pl. 14; Schimp. Versuch Torfm. pl. 13, f. 1–6; pl. 14; Braithw. Sphag. pl. 18; G. Roth, Eur. Torfm. pl. 3, f. 1–4; pl. 8, f. 8–9; pl. 10, f. 8. EXSICC.: Aust. Musc. App. 15; Sull. & Lesq. Musci Bor. Am. 10b; Eaton & Faxon, Sphag. Bor. Am. Exs. 40–42, 43 (in part), 44–50; Macoun, Can. Musci 576; Ren. & Card. Musci Am. Sept. Exs. 258, 261.

Sphagnum capillaceum tenellum (Schimp.) A. L. Andrews. (*S. rubellum* Wilson, Bryol. Brit. 19. 1855; *S. acutifolium tenellum* Schimp. Mém. Sphaig. 64. 1857; *S. tenellum* H. Klinggr. Schr. Phys.-ok. Ges. Königsb. 13: 4. 1872; *S. Wilsoni* Roll, Flora 69: 79. 1886; *S. subtile* Warnst. Krypt.-fl. Brand. 1: 428. 1903.) Stem-leaves more lingulate with hyaline cells mostly divided: branch-leaves tending to be somewhat subsecund, relatively shorter and with laxer areolation than in the type. Generally dioicous. Greenland and Labrador to New Jersey; Washington to Alaska; also in South America and Europe. ILLUSTRATIONS: Wilson, Bryol. Brit. pl. 60; Braithw. Sphag. pl. 19; G. Roth, Eur. Torfm. pl. 8, f. 2, 3. EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 29–32; Macoun, Can. Musci 5; Ren. & Card. Musci Am. Sept. Exs. 146.

35. *Sphagnum quinquefarium* (Lindb.) Warnst.

Hedwigia 25: 222. 1886.

Sphagnum acutifolium quinquefarium Lindb.; Braithw. Sphag. 71. 1880.

Sphagnum Bartlettianum Warnst. in Engler, Pflanzenreich Sphag. 105. 1911.

Plants fairly robust, not infrequently tall, light-green or yellowish or more or less tinged with rosy-red. Wood-cylinder greenish-yellow; cortical cells of the stem in 2–4 layers, large, thin-walled, without fibrils, the outer cells quadrilateral to irregularly pentagonal or hexagonal, sometimes as wide as long, rarely with occasional pores: stem-leaves small, triangular to lingulate-triangular, commonly as wide as long, concave, involute at the toothed apex, the border strong, at the base occupying nearly the whole breadth of the leaf, the walls of its cells pitted; hyaline cells rhomboidal, 3–4 times as long as wide in the apical part, narrower below and at the sides, mostly without fibrils, in the apical part of the leaf often divided, the membrane on the inner surface resorbed in large membrane-gaps, on the outer surface with small gaps in a few cells of the immediate apex, otherwise entire, often with longitudinal membrane-pleats: branches in fascicles of 5, generally at least 3 spreading, their cortical cells in a single layer, the retort-cells well developed with conspicuous necks, often a second retort-cell above the first: branch-leaves imbricate or generally loosely spreading in 5 ranks, small, lanceolate, slightly involute near the toothed apex, the border entire, of 2–3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 8–12 times as long as wide near the base, shorter above to 4–5 times, on the inner surface with small pores in the ends of the cells, in the lower side-regions with large ringless pores, up to 4–5 per cell, on the outer surface with rather small ringed elliptic pores near the commissures, increasing gradually in size toward the base, 3–8 per cell: chlorophyll-cells triangular in section with the base exposed on the inner surface; hyaline cells very slightly if at all convex on the inner surface except in the basal part of the leaf, decidedly convex on the outer surface, one third to one half of the diameter of the cell.

Commonly monoicous. Antheridia in catkins on spreading branches; antheridial leaves reddish, broader in proportion to length than the normal branch-leaves, abruptly involute at the apex, fibrils lacking or rudimentary in the hyaline cells of the basal one fourth to one third. Fruiting branches erect, short; perichaetial leaves lingulate-ovate, abruptly involute at the apex, with both kinds of cells in the upper middle portion, the hyaline cells rhomboidal, often once or several times divided, without fibrils or pores: capsule brown: spores yellow, about 20 μ in diameter, slightly granular-roughened.

TYPE LOCALITY: Europe.

DISTRIBUTION: Newfoundland to Georgia; also in Europe and Asia.

ILLUSTRATIONS: Braithw. Sphag. pl. 21, f. 5; G. Roth, Eur. Torfm. pl. 7, f. 5; pl. 8, f. 4.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 36–39; Macoun, Can. Musci 596; Ren. & Card. Musci Am. Sept. Exs. 259.

36. *Sphagnum meridense* (Hampe) C. Müll. Syn. 1: 95. 1848.

Sphagnum acutifolium meridense Hampe, *Linnaea* 20: 66. 1847.
Sphagnum Antillarum Besch. Ann. Sci. Nat. VI. 3: 263. 1876.
Sphagnum platycladum C. Müll. *Flora* 70: 417. 1887.
Sphagnum Lesueurii Warnst. *Hedwigia* 29: 205. 1890.
Sphagnum costaricense Warnst. Bull. Herb. Boiss. 2: 401. 1894.
Sphagnum Tonduzii Warnst. Bot. Centr. 82: 40. 1900.

Plants sometimes delicate and slender, generally very robust, bright-green or whitish, mostly tinged with red. Wood-cylinder greenish to somewhat reddish; cortical cells of the stem in 2-3 layers, large, thin-walled, without fibrils, the outer cells quadrilateral or pentagonal, mostly longer than broad, without pores: stem-leaves small to medium-sized, triangular-ovate, nearly twice as long as wide, concave especially near the toothed apex, the border strong, more or less broadened at the base, with pitted cell-walls; hyaline cells rhomboidal, 2-3 times as long as wide at the apex, narrower toward the sides and base, normally without fibrils, sometimes a few cells fibrillose, occasionally once divided, the membrane of the inner surface considerably resorbed in round or irregular gaps, generally several (up to 6) per cell, reduced or lacking toward the sides and base, the membrane on the outer surface mostly entire with longitudinal membrane-pleats: branches in fascicles of 5 or 6, 2 spreading, their cortical cells in a single layer, without fibrils, the retort-cells well differentiated with inconspicuous necks, often a second retort-cell above the first: branch-leaves loosely imbricate or spreading, medium-sized to large according to the size of the plants, ovate-oblong, very concave, abruptly short-pointed by an involute apex which is finally truncate and toothed, the border entire, of 1-2 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 8-10 times as long as wide at the base, shorter above to 6-8 times at the apex, on the inner surface with numerous round pores of good size in the corners and along the commissures, 2-10 per cell, on the outer surface varying much, sometimes with very few pores in the ends and corners of the cells, at other times with numerous pores along the commissures, the number of pores varying inversely with the amount of exposure of chlorophyll-cells on the outer surface, sometimes with very small strongly ringed pores in the central portion of the cells: chlorophyll-cells varying in section from triangular with the base exposed on the inner surface to truncately elliptic or nearly rectangular with approximately equal exposure on both surfaces, the lumen large, lenticular in the latter case; hyaline cells convex on the inner surface, up to one fifth of the diameter of the cell, on the outer surface slightly more so, up to one fourth of the diameter, or more in the case of triangular chlorophyll-cells.

Dioicous, rarely monoicous. Antheridia in catkins on spreading branches; antheridial leaves more or less tinged red, otherwise hardly differentiated from the normal branch-leaves. Fruiting branches erect, sometimes rather long; perichaetial leaves ovate to ovate-lanceolate, some abruptly involute at the apex, with both kinds of cells in the upper middle portion, the hyaline cells sometimes divided, without fibrils or pores: capsule dark-brown: spores yellow, about 20 μ in diameter, their surface granular-roughened.

TYPE LOCALITY: Merida, Venezuela.

DISTRIBUTION: Florida; West Indies; Mexico; Central America; also in South America.

ILLUSTRATIONS: *Hedwigia* 29: pl. 4-7, *passim*.

EXSICC.: Husnot, Pl. Ant. 191; Pringle, Musci Mex. 10462, 10648.

37. *Sphagnum plumulosum* Röhl, *Flora* 69: 89. 1886.

Sphagnum sulmitens Russow & Warnst.; Warnst. Verh. Bot. Ver. Prov. Brand. 30: 115. 1888.
Sphagnum nitidum Warnst. Allg. Bot. Zeits. 1: 94. 1895.

Plants usually robust, greenish or yellowish, frequently more or less tinged with brown which passes to purplish, the leaves often displaying somewhat of a metallic luster. Wood-cylinder greenish or slightly tinted brown; cortical cells of the stem in 3-4 layers, large and thin-walled, without fibrils, the outer cells quadrilateral to irregularly pentagonal, often as wide as long, without pores: stem-leaves large, elongate-triangular, mostly twice as long as wide or more, abruptly involute-pointed, toothed across the broadly truncate apex, the border strong, broadened in the basal angles, the walls of its cells strongly pitted; hyaline cells rhomboidal, 4-6 times as long as wide in the apical part, narrower below and toward the sides, without fibrils, mostly once or several times divided, the membrane on the inner surface mostly resorbed in large gaps, on the outer surface entire with longitudinal membrane-pleats:

branches in fascicles of 3-5, generally 2 spreading, their cortical cells in a single layer, without fibrils, the retort-cells not prominent, with inconspicuous necks: branch-leaves loosely imbricate or spreading to slightly squarrose, large, ovate-lanceolate, involute above in a long sharp point to a toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal near the base where 10-14 times as long as wide, shorter above to 6-8 times in the apex, on the inner surface with only minute pores in the ends of the cells and larger round pores in the cells of the side-region, 1-4 per cell, on the outer surface with large elliptic pores near the commissures, 4-10 per cell: chlorophyl-cells triangular to trapezoidal in section, more broadly exposed on the inner surface, the lumen triangular; hyaline cells slightly convex on the inner surface, more strongly so on the outer, up to two-thirds of the diameter of the cell or more.

Monoicous or dioicous. Antheridia in catkins on spreading branches; antheridial leaves pigmented purplish-brown. Fruiting branches erect, short; perichaetial leaves ovate to obovate, abruptly involute at the apex, with both kinds of cells in the upper middle portion, the hyaline cells small, rhomboidal, regularly once to several times divided, without fibrils or pores: capsule dark-brown: spores brown-yellow, 20-25 μ in diameter, papillose.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador to New Jersey; California; Vancouver Island; also in Europe and Asia.

ILLUSTRATIONS: Verh. Bot. Ver. Prov. Brand. 30: pl. 4, f. 22bc, 23bc; G. Roth, Eur. Torfm. pl. 8, f. 5, 6.

EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 56, 57.

Sphagnum plumulosum flavicomans (Card.) A. L. Andrews. (*S. acutifolium flavicomans* Card. Rev. Bryol. 11: 55. 1884; *S. subnitens flavicomans* Warnst. Verh. Bot. Ver. Prov. Brand. 30: 118. 1888; *S. subnitens obscurum* Warnst. Bot. Gaz. 15: 196. 1890; *S. flavicomans* Warnst. in Engler, Pflanzenreich Sphag. 79. 1911.) Plants remarkably tall and robust, brown throughout, the whole plant less lax: retort-cells of the branches with conspicuous necks: branch-leaves closely imbricate: seldom fruiting. Greenland and Labrador southward along the coast to New Jersey. ILLUSTRATIONS: Verh. Bot. Ver. Prov. Brand. 30: pl. 3, f. 9ab, 4, f. 22a, 23a. EXSICC.: Eaton & Faxon, Sphag. Bor. Am. Exs. 51-55.

38. *Sphagnum tenerum* Sull. & Lesq.; Sull. in A. Gray, Man. ed. 2. 611. 1856.

Sphagnum Evansii Warnst. Hedwigia 47: 99. 1907.

Sphagnum Eatonii Warnst. Hedwigia 47: 100. 1907.

Plants compact, often robust, yellowish or whitish, more or less tinged with pink or red, Wood-cylinder yellowish-green to red; cortical cells of the stem in 2-3 layers, large, thin-walled without fibrils, the outer cells quadrilateral to pentagonal, frequently as wide as long, without pores: stem-leaves very large, triangular-ovate, concave, involute toward the apex, the border narrow above, of 2-3 rows of narrow cells, slightly broadened at the base, the walls of its cells pitted; hyaline cells rhomboidal, 6-8 times as long as wide at the apex, longer toward the base, fibrillose throughout or nearly so, frequently divided, on the inner surface with numerous large rounded pores, 3-5 per cell, on the outer surface with numerous elliptic pores along the commissures, becoming cell-wide in the basal part of the leaf: branches in fascicles of 4 or 5, 2 spreading, their cortical cells in a single layer, without fibrils, the retort-cells well developed, with conspicuous necks: branch-leaves closely imbricate, large, ovate, slightly involute toward the toothed apex, the border entire, of 2-3 rows of narrow cells; hyaline cells fibrillose, narrowly rhomboidal, 8-12 times as long as wide at the base, shorter above to 5-6 times, on the inner surface with small pores in the ends of the cells in the apical part, in the lower side-regions with numerous large rounded pores, up to 7-8 per cell, on the outer surface with narrowly elliptic pores along the commissures, 6-15 per cell: chlorophyl-cells in section very small, narrowly triangular or trapezoidal or almost ellipsoid, exposed on the inner surface, the lumen of similar shape, very small; hyaline cells convex on the inner surface, up to one-fifth of the diameter of the cell, very strongly convex on the outer surface, mostly one-half of the diameter of the cell or more, without resorption-furrow.

Commonly monoicous. Antheridial branches like the others except as the antheridial leaves are more strongly tinged red, the fibrils of the latter somewhat weakened in the basal hyaline cells. Fruiting branches erect, short; perichaetial leaves relatively small, ovate,

abruptly narrowed to an involute point, the apex finally blunt or truncate, with uniform cells throughout or nearly so, the latter narrow, very convex, with pitted walls: capsule brown: spores bright-yellow, 25–30 μ in diameter, coarsely roughened.

TYPE LOCALITY: Raccoon Mountains, Alabama.

DISTRIBUTION: Newfoundland to Alabama.

ILLUSTRATION: G. Roth, Eur. Torfm. pl. 7, f. 9.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 11; Eaton & Faxon, Sphag. Bor. Am. Exs. 58–61.

39. *Sphagnum tabulare* Sull. Musci Allegh. 207. 1845.

Sphagnum molle Sull. Musci Allegh. 205. 1845.

Sphagnum molluscoides C. Müll. Syn. 1: 99. 1848.

Sphagnum Mülleri Schimp. Versuch Torfm. 73. 1858.

Sphagnum labradorens Warnst. Hedwigia 31: 174. 1892.

Plants compact, low, yellowish or whitish, tinged with flesh-color or reddish. Wood-cylinder mostly yellowish; cortical cells of the stem in 2–4 layers, large, thin-walled, without fibrils, the outer cells quadrilateral to pentagonal or hexagonal, mostly as wide as long, without pores: stem-leaves large, ovate, twice as long as wide, concave, slightly involute toward the broad toothed apex, the border very narrow, only slightly broadened at the base, the walls of its cells pitted; hyaline cells rhomboidal, 2–4 times as long as wide at the apex, lengthening downward, with or without fibrils, sometimes once divided, the membrane on the inner surface resorbed in larger or smaller gaps, one to several per cell, on the outer surface the membrane entire with longitudinal membrane-pleats in non-fibrillose cells, in fibrillose cells with pores as in the branch-leaves: branches short, in closely disposed fascicles of 3 or more, mostly ascending, their cortical cells in a single layer, without fibrils, the retort-cells very large with conspicuous necks: branch-leaves closely or loosely imbricate or spreading to almost squarrose, large, ovate, very concave, involute throughout, the apex toothed; the border narrow, of 1–2 rows of cells, distantly denticulate; hyaline cells fibrillose, narrowly rhomboidal, 8–10 times as long as wide at the base, shorter above to 5–6 times, on the inner surface with small pores in the ends of the cells, rarely also in the side-corners, with larger rounded pores in the cells of the side-regions, altogether 2–5 per cell, on the outer surface with narrowly elliptic pores close to the commissures, 5–10 per cell: chlorophyll-cells small in section, usually triangular with a very small lumen, the base exposed on the inner surface of the leaf; hyaline cells quite convex on the inner surface, very strongly so on the outer, up to two-thirds of the diameter of the cell, the resorption-furrow at the edge, lacking however in some sections.

Monoicous. Antheridial branches hardly differentiated except as the antheridial leaves are slightly pigmented red. Fruiting branches short, erect; perichaetial leaves small, ovate-lanceolate to lanceolate, gradually long-apiculate, the apex finally obtuse or narrowly truncate, toothed, with both kinds of cells in the upper central region, the hyaline cells not infrequently fibrillose, the pores occasional in the corners of fibrillose cells: capsule brown: spores greenish-yellow, about 30 μ in diameter, very minutely granular-roughened.

TYPE LOCALITY: Table Mountain, Burke County, North Carolina.

DISTRIBUTION: Newfoundland to Florida and Alabama; also in Europe.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 4, 5; Schimp. Versuch Torfm. pl. 26; Braithw. Sphag. pl. 12; G. Roth, Eur. Torfm. pl. 3, f. 7.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 15, 16; ed. 2. 20; Eaton & Faxon, Sphag. Bor. Am. Exs. 62.



Order ANDREAEALES

By ELIZABETH GERTRUDE BRITTON

Protonema normally thallose. Calyptra small, apical. Sporogonium ovoid, borne on an elongate pseudopodium; capsule rupturing by longitudinal slits, without seta, lid, or peristome. Archegonium surrounding the columella, which does not penetrate the spore-sac at the apex.

(A single family:)

Fam. 1. ANDREACEAE.

VOLUME 15, PART 1, 1913]



Family 1. ANDREAEACEAE

BY ELIZABETH GERTRUDE BRITTON AND JULIA TITUS EMERSON

Small, tufted, dark-colored mosses, growing on rocks. Stems without a central strand, of uniform densely thickened stereid-cells with large oil-globules. Leaves with the cells much thickened or densely papillose, the lumen usually much obscured and irregular by the thickening of the walls. Perichaetial leaves either slightly differentiated, or larger, erect, and convolute. Sporogonium without a true seta but exerted on a pseudopodium at maturity, splitting into 4-8, or rarely 5-10 valves, closed when moist, open and depressed when dry, with a thick persistent columella not penetrating the spore-sac, which is developed from the circumference of the endothecium. Air-cavities or intercellular spaces none. Spores with a thick, dark-brown exospore. Protonema normally thallose, beginning its development before the rupturing of the exospore.

1. ANDREAEA Ehrh. (Hannov. Mag. 16 : 1601; hyponym. 1778) Beitr. 1 : 180. 1787.

Plants perennial, growing in loosely coherent dark-green, brown, or black patches on silicious or granitic rocks, in high altitudes or latitudes. Stems usually brittle, erect or decumbent, radiculose only at the base with thickened cylindric or flattened rhizoids; cross-section without a central strand, with more or less uniform thick-walled cells, usually more dense on the circumference. Branches simple or fastigiate; leaves crowded, usually with an erect clasping base and the upper half spreading or secund, costate or ecostate, smooth or papillose, either of one layer of cells or with the apex terete and filled with stereid-cells; cells in regular longitudinal rows, small, with thick walls and small irregular lumen. Monoicous or dioicous. Antheridia usually in gemmiform buds, on separate branches. Capsules terminal, solitary, sessile, maturing in the large, erect, usually sheathing perichaetium, becoming exerted on a short pseudopodium; valves 4-8, rarely 5-10, usually remaining united at base and apex; columella persistent. Calyptra small, fugacious, campanulate, and lacerate at base. Spores smooth or rough, forming a thallose more or less branched and thickened protonema.

Type species, *Andreaea petrophila* Ehrh.

Stem-leaves different from the larger, convolute, perichaetial leaves. (EUANDREAEA.)

Leaves ecostate.

Leaves secund or incurved, papillose or nearly smooth.

Leaves acute or acuminate, asymmetric; plants up to 5 cm. high.

Leaves blunt and cucullate, symmetric; plants up to 1.5 cm. high.

Leaves not secund, papillose or mamilliose.

Leaves ovate-acuminate, papillose; plants up to 7 cm. high.

Leaves ovate-lanceolate, papillose; plants up to 1.5 cm. high.

Leaves panduriform, mamilliose; plants up to 4 cm. high.

Leaves costate.

Costa ending in or below the apex.

Costa more or less excurrent, filling most of subula.

Leaves abruptly narrowed, the awn terete, papillose.

Leaves gradually narrowed, the awn flat, smooth or mamilliose.

Stem-leaves and perichaetial leaves similar, not convolute, costate. (CHASMO-CALYX.)

1. *A. petrophila*.

2. *A. alpestris*.

3. *A. papillosa*.

4. *A. turgescens*.

5. *A. obovata*.

6. *A. rupestris*.

7. *A. crassinervia*.

8. *A. Blyttii*.

9. *A. nivalis*.

1. *Andreaea petrophila* Ehrh. (Hannov. Mag. 22: 140; hyponym.
1784) Beitr. 1: 192. 1787.

Andreaea rupestris Hedw. Sp. Musc. 47, in part. 1801.

Andreaea petrophila acuminata Schimp.; B. S. G. Bryol. Eur. (62-64:) Andr. 13. 1855.

Andreaea sublaevis Kindb. Eur. & N. Am. Bryin. 393. 1897.

Common on rocks in high altitudes or latitudes and very variable. Plants caespitose in dense dark-green, brown, or black cushions; stems brittle or rigid when dry, 1-2, seldom 3-5, cm. high, slender, simple or branching; leaves crowded and erect-appressed when dry, the upper half spreading, secund or homomalous when moist, usually asymmetric, variable in size, 0.7-1.5 mm. long by 0.2-0.7 mm. wide, ecostate, nearly smooth or distinctly rough with hyaline papillae on the back, the base erect, clasping, oblong, the upper part ovate-acuminate, the apex often falcate, acute or rarely mucronate, sometimes crenulate and hyaline; margins entire, incurved, also sometimes hyaline; basal cells oblong and smooth with thick porose walls and narrow, linear or irregular lumen, shorter in the middle and upper part of the leaf with thicker walls and angled lumen; perichaetial leaves larger, 10-12, erect and convolute, often blunt and lighter in color, 1-3 mm. long, the inner smooth, the outer papillose. Autoicous: antheridia in lateral buds, on separate branches with small, smooth bracts: pseudopodium immersed or slightly exserted, straight or curved: calyptra small, apical, fugacious: capsules small, about 1 mm. long, paler at base, with a short neck, split three-fourths of the way down into 4 thick-walled valves: spores brown, 20-30 μ in diameter, globose or ovoid, unequal, slightly roughened, maturing in summer.

TYPE LOCALITY: Europe.

DISTRIBUTION: Greenland and Labrador to Nova Scotia and Alaska and along the Alleghenies to Virginia; in the Rocky Mountains to Colorado; coast ranges from California to British Columbia; also in Europe.

ILLUSTRATIONS: Hedw. Sp. Musc. pl. 7, f. 2 (as *A. rupestris*); B. S. G. Bryol. Eur. pl. 623-626; Braithw. Brit. Moss-Fl. pl. 1.

EXSICC.: Drummond, Musci Am. 1; Sull. Musci Allegh. 215; Sull. & Lesq. Musci Bor. Am. 13; ed. 2: 24; Aust. Musci App. 42; Macoun, Can. Musci 16; Ren. & Card. Musci Am. Sept. Exs. 201; Holz. Musci Acroc. Bor. Am. 226.

2. *Andreaea alpestris* (Thed.) Schimp.; B.S.G. Bryol. Eur. (62-64 :)
Andr. 16. 1855.

Andreaea petrophila alpestris Thed. Bot. Notiser 1849: 79. 1849.

Andreaea petrophila heteromalla alpestris J. E. Zett. Monog. Andr. 42. 1855.

Andreaea parvifolia C. Müll. Flora 70: 219. 1887.

In high altitudes or latitudes, growing in lax pale-yellow, brown, or black tufts; stems very slender and short, 0.75-1.5 cm. high, erect or decumbent; branches subapical, sometimes arising within the perichaetium: leaves crowded, imbricate-appressed when dry, the base erect, ventricose, the upper half spreading or incurved when moist, all very small, 0.5-0.8 mm. long, ovate to ovate-lanceolate, or shortly acuminate, ecostate, either with low and inconspicuous dorsal papillae or strongly papillose; margins slightly incurved; apex cucullate, blunt, rarely hyaline; lower median cells linear-porose, the marginal and upper cells much shorter, with irregular, angled lumen; perichaetial leaves 5-7, longer and lighter-colored, convolute, up to 1.5 mm. long, smooth or papillose above, ecostate, the apex blunt. Autoicous or rarely dioicous: antheridial buds often numerous on branches overtopping the capsules: pseudopodium short: capsule exserted, ovate-oblong, small, less than 1 mm. in diameter, split three-fourths of the way down, with a short, pale neck: spores varying from spheric to ovoid, 18-29 μ in diameter, maturing in summer.

TYPE LOCALITY: Switzerland.

DISTRIBUTION: Greenland and Newfoundland to New Hampshire; Montana to British Columbia and Alaska; Volcan del Fuego, Guatemala; also in Europe.

ILLUSTRATIONS: Bot. Notiser 1849: f. 45-47; B. S. G. Bryol. Eur. pl. 626.

EXSICC.: Holz. Musci Acroc. Bor. Am. 276.

3. *Andreaea papillosa* Lindb. Oefv. Sv. Vet.-Akad.
Förh. 23: 557. 1867.

Plants large, 5-7 cm. high, robust, the tufts lax, somewhat glossy, dark-brown to black, often yellow at the apex; stems rigid, erect, branching repeatedly: leaves erect-appressed and

closely imbricate when dry, the upper half spreading when moist, ovate-acuminate, sometimes slightly larger above the base or rarely very long-acuminate, from an erect, paler, clasping base, 1-1.25 mm. long, ecostate and coarsely papillose above on the back, with large hyaline papillae in regular rows; margins entire below, minutely crenulate-denticulate above, incurved; apex slightly cucullate; cells all much thickened and porose, the basal ones square or oblong, smooth, with linear sinuous lumen, the median and apical ones shorter, with round or angled lumen; the marginal ones oblique; perichaetial leaves about 10, oval or oblong, convolute, 2-3 mm. long, acute, often crenulate-denticulate, papillose on the back above the base. Autoicous: antheridial buds few, on slender branches: "capsule as in *A. petrophila*: spores about 22 μ in diameter, maturing in August." Not seen.

TYPE LOCALITY: Spitzbergen.

DISTRIBUTION: Greenland; also in northern Europe.

4. *Andreaea turgescens* Schimp.; C. Müll. Syn. 2: 515. 1851.

Densely caespitose, about 1.5 cm. tall, dark-brown; stems erect and noticeably clavate; branches terete: leaves crowded, ascending, imbricate when dry, spreading in all directions when moist, brown, ovate-lanceolate, rarely obovate or lanceolate, ecostate, 1-1.5 mm. long by 0.2-0.3 mm. wide; margin entire or slightly crenate, strongly incurved along the upper part of the leaf; apex blunt or slightly cucullate, very papillose on the back; cells oblong at the base of the leaf, about 44 μ long by 11 μ wide, short and round above, very thick-walled, with narrow lumen; perichaetial leaves at least 10, sheathing, much larger than stem-leaves, 1.5 mm. to 3 mm. long by about 0.5 mm. wide, lighter-brown, broadly lanceolate, gradually acuminate; margins involute; apex sometimes premorse; basal cells very porose; upper cells with large and prominent papillae in regular rows: perigonal leaves shorter and broader: "capsule as in *A. petrophila*: spores not seen: capsules immature."

TYPE LOCALITY: Summit of Mount Orizaba, Mexico.

DISTRIBUTION: Mount Orizaba; also on Nevado de Toluca, 4200-4500 meters, with *Grimmia fuliginosa*.

5. *Andreaea obovata* Thed. Bot. Notiser 1849: 78. 1849.

Plants densely pulvinate, the tufts brown or almost black; stems 2-4 cm. high, slender, often naked at the base; branches fastigiate and numerous: leaves imbricate, erect-appressed when dry, the upper half spreading or incurved when moist, from an erect, clasping base; symmetric, oblong-ovate or panduriform; upper half broadly acuminate, 0.9-1.25 mm. long, ecostate and nearly smooth, mamilllose, or with brown, not hyaline papillae on the back; margins incurved, entire or slightly crenulate above; apex blunt; basal cells linear, sinuous and porose, the upper cells shorter, with very thick walls and irregularly angled, rhombic or rounded lumen; leaf-section showing a single layer of brown-walled cells, flat on the inner surface, mamilllose on the outer; perichaetial leaves erect, convolute, 2-3 mm. long, broader above the middle, often hyaline or erose at the apex; cells linear, sinuous, porose. Autoicous: antheridia often on separate, slender branches: pseudopodium often slightly exserted or immersed: calyptra hyaline, lobed: capsule about 1 mm. long, split three-fourths of the way to the base, with a short, pale neck: spores smooth, green or brown, globose or ovoid, 21-27 μ in diameter, maturing in summer.

TYPE LOCALITY: Sneehätten, Dovrefjeld, Norway.

DISTRIBUTION: Greenland; also in Scandinavia and Spitzbergen.

ILLUSTRATIONS: Bot. Notiser 1849: f. 27-36; B.S.G. Bryol. Eur. pl. 627.

EXSICC.: Holz. Musci Acroc. Bor. Am. 252.

6. *Andreaea rupestris* (L.) Hedw. Sp. Musc. 47. 1801.

Jungermannia rupestris L. Sp. Pl. 1135. 1753.

Andreaea Rothii Weber & Mohr, Bot. Tasch. 386. 1807.

Andreaea falcata Schimp.; B.S.G. Bryol. Eur. (62-64:) Andr. 24. 1855.

In brown or black tufts, 1.5 cm. tall; stems dichotomous or fastigiate, often bare at the base: leaves spreading or secund, generally more or less falcate above, 0.9-1 mm. long, the upper half incurved or subsecund from an oblong or slightly ovate base, either gradually or suddenly narrowed to a long-lanceolate acuminate point; apex blunt; margin entire, crenate,

or erose-dentate; costa strong, semi-terete, prominent and rough at the back, ending in or below the apex, sometimes obsolete at the base; blade consisting of about five rows of cells, gradually narrower to the apex, the cells 8–14 μ long, thick-walled and mamilllose above, the basal ones quadrate near the margin, linear-oblong in the middle, all with an irregular, small lumen; perichaetial leaves 1.5–2 mm. long, the 3 outer ones erect, costate, broadly ovate with an acuminate point, occasionally slightly papillose above, the inner convolute, ecostate. Autoicous: perigonal leaves few, the outer erect with short points, costate only at the apex, the inner ecostate: capsule oblong-ovate, brown or black, 0.8 mm. long, splitting three-fourths of the way to the base: spores large, 32–37 μ in diameter, brown, slightly roughened, maturing in early summer.

TYPE LOCALITY: Mt. Snowden, Wales.

DISTRIBUTION: Greenland and Newfoundland to Ontario, and southward in the mountains to Alabama. Not reported from the Rocky Mountains or coast ranges; specimens distributed by Macoun from Mount Arrowsmith, British Columbia, as *Andreaea Huntii* are a mixture of *A. rupestris* and *A. alpestris*. Also in Europe.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 73, f. 40; Weber & Mohr, Bot. Tasch. f. 7–8; B.S.G. Bryol. Eur. pl. 631, 634.

EXSICC.: Sull. Musci Allegh. 214; Sull. & Lesq. Musci Bor. Am. 19; ed. 2. 25; Aust. Musci App. 43; Ren. & Card. Musci Am. Sept. Exs. 153; Holz. Musci Acroc. Bor. Am. 302.

7. *Andreaea crassinervia* Bruch, Abh. Akad.

Münch. 1: 279. 1832.

Plants growing on alpine rocks in black, somewhat glossy tufts; stems 1–2 cm. high, slender and brittle, often prostrate at the base; branches erect, fastigate: leaves crowded, falcate-secund when dry, spreading when moist, 0.9–1.25 mm. long, the base short, concave, oblong, tapering into the long slender terete subula; margin entire; costa broad at the base, several layers of cells thick, rough above with mamilllose or papillose cells, the upper cells round or square, the basal ones oblong, not sinuous nor porose, the walls thick; perichaetial leaves few, 2–4, convolute, 1.5–2 mm. long, ovate, apiculate, the outer ones costate only at the apex, smooth or with low papillae, the inner ones longer, ecostate. Autoicous: perigonal leaves few, small, acute, ecostate, with or without papillae; antheridia few; paraphyses numerous, filiform: capsule short, scarcely 1 mm. long: spores 28–32 μ in diameter, dark-brown, slightly rough, maturing in summer.

TYPE LOCALITY: Grimsel, Switzerland.

DISTRIBUTION: Greenland; Newfoundland; Maine to the White Mountains of New Hampshire; also in Europe.

ILLUSTRATIONS: Abh. Akad. Münch. 1: pl. 10; B.S.G. Bryol. Eur. pl. 633.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 20; ed. 2. 26; Holz. Musci Acroc. Bor. Am. 301.

8. *Andreaea Blyttii* Schimp.; B.S.G. Bryol. Eur. (62–64:)

Andr. 25. 1855.

Andreaea perichaetialis J. E. Zett. Monog. Andr. 26. 1855.

Andreaea obtusifolia Bergr.; G. Roth, Aussereur. Laubm. 1: 72. 1910. Not *A. obtusifolia* T. Jens. 1858.

Plants in low, brown or black tufts; stems short, seldom more than 1–2 cm. high, rigid and brittle; branches slender, subapical: leaves spreading or slightly secund at the apex, lanceolate-subulate, 1–2 mm. long, the base short, ovate or oblong, more or less abruptly narrowed into a longer, slender smooth subula; costa flat at the base, thickened above, filling the subulate apex, not conspicuous nor differing much in color from the rest of the leaf, the cells of the point round or square, with thick walls, often mamilllose, the basal ones oblong, not sinuous or porose; margins entire; perichaetial leaves 8, larger than the stem-leaves, 1–2.5 mm. long, concave, convolute, the outer ones erect, costate to the apex, the inner ones shorter, apiculate, ecostate. Dioicous, the male plants more slender: perigonal leaves 6, shorter than the stem-leaves, ovate, acute, ecostate; antheridia 5–6, long-stalked; paraphyses long and filiform: capsule black and very small, 0.75 mm. in diameter, ovate-conic, apiculate; neck short: spores small, 11–14 μ in diameter, brown and smooth, maturing in summer.

TYPE LOCALITY: Reno Island, Finmark, Norway.

DISTRIBUTION: Arctic America, Davis Straits, and Greenland; also in Europe.

ILLUSTRATIONS: B.S.G. Bryol. Eur. pl. 635; G. Roth, Aussereur. Laubm. 1: pl. 7, f. 6.

EXSICC.: Holz. Musci Acroc. Bor. Am. 251.

9. *Andreaea nivalis* Hook. Trans. Linn. Soc. 10: 395. 1811.*Andreaea nivalis fuscescens* Hook. Trans. Linn. Soc. 10: 395. 1811.*Andreaea Macounii* Kindb.; Macoun, Bull. Torrey Club 17: 83. 1890.

Plants large and soft, growing in fulvous or dark-brown tufts on alpine rocks near the snow-line; stems erect or decumbent, bare and discolored at the base, slender, not rigid, 4-6 cm., rarely 10 cm., high; branches few, subapical, flexuose and secund at the apex: leaves distinctly falcate-secund when dry, more spreading when moist, distant and smaller on the apical branches, 1-1.5 mm. long, lanceolate-acuminate from an oblong base, slightly auricled and concave at the basal angles, usually flat or slightly channeled above; costa strong, brown, percurrent or ending in the rough subulate apex, dentate, or papillose on the back; margin entire or irregularly toothed at the base, sinuous-dentate and papillose at the apex; cells papillose on both surfaces, square or rounded, not elongate nor porose at the base, less opaque and irregular than in other species; perichaetial leaves not convolute, similar to the stem-leaves but larger, 2-2.5 mm. long. Dioicous, often sterile: antheridia in small buds, long-stalked; paraphyses filiform; bracts broad-ovate, ecostate, apiculate: capsule brown, almost 1 mm. long, splitting into 4-6 valves: spores brown, almost smooth, 21-24 μ in diameter, maturing in summer.

TYPE LOCALITY: Ben Nevis, Scotland.

DISTRIBUTION: At 1950-2100 meters alt., Mount Tacoma, Washington, and Gold Range, British Columbia; reported from Oregon; also in Europe.

ILLUSTRATIONS: Trans. Linn. Soc. 10: *pl. 31, f. 4*; B.S.G. Bryol. Eur. *pl. 636*.

EXSICC.: Macoun, Can. Musci 401.



Order BRYALES

BY ELIZABETH GERTRUDE BRITTON AND ROBERT STATHAM WILLIAMS

Protonema normally filamentous, except in *Tetraphidaceae* and *Buxbaumiaceae*. Calyptra normally apical. Sporogonium with a more or less elongate seta; sporangium rudimentary and indehiscent or dehiscent by a lid, the peristome present or absent. Spores developed from an archesporium surrounding the columella, the latter continuous through to the lid, except in a few genera where it is absent or disappears during the development of the spores. Assimilating tissue normally present in an air-space separating the endothecium from the amphithecium; neck or hypophysis often strongly developed, sometimes greatly expanded, and normally containing stomata, more or less perfectly developed.

Fruit mostly terminal on the stems, or later often terminal on lateral branches; often appearing lateral by innovations from just below the apex. (Plants "acrocarpous.")

Capsule breaking open irregularly, without a lid when mature or the partially developed lid very small and not dehiscent on the ripening of the spores. (Plants "cleistocarpous.")

Calyptra ruptured above by the growing capsule and persistent at the base of the seta as a ragged membrane.

Fam. 1. ARCHIDIACEAE.

Calyptra ruptured at the base and remaining at the apex of the growing capsule.

Capsule ovate to somewhat pyriform, acutely pointed, mostly with a distinct neck, immersed or exerted; calyptra conic-lobate.

Bruchia in Fam. 2. BRUCHIACEAE.

Capsule ovate, acutely pointed, without a distinct neck, immersed; calyptra cucullate.

Pleuridium in Fam. 3. DITRICHACEAE.

Capsule globose, immersed; calyptra small and conic-cucullate.

Genera in Fam. 10. TORTULACEAE.

Capsule opening on the ripening of the spores by a well defined lid. (Plants "stegocarpous.")

Peristome lacking.

Sterile stems with leaves longitudinally inserted in two rows and united at their bases; fertile stems with leaves in two rows below and in several rows above.

Fam. 18. SCHISTOSTEGACEAE.

Sterile and fertile stems uniformly developed.

Fam. 4. BRYOXIPHIACEAE.

Leaves with a dorsal wing.

Leaves without a dorsal wing.

Archegonia lateral.

Pleurozygodon in Fam. 13. ORTHOTRICHACEAE.

Archegonia terminal.

Upper leaf-cells large, mostly 20 μ wide or more, usually elongate, never papillose; cell-walls uniformly thin throughout the leaf.

Capsule with a nearly cylindric, slender neck, about twice as long as the sporangium.

Fam. 15. ORDIPODIACEAE.

Capsule with a more or less tapering, stouter neck, shorter or little longer than the sporangium, sometimes lacking.

Lid with an acicular beak.

Trematodon sp. in Fam. 2. BRUCHIACEAE.

Lid never with an acicular beak.

Genera in Fam. 17. FUNARIACEAE.

Upper leaf-cells much smaller, rounded 4-6-sided, scarcely or not elongate, mostly papillose or mamilllose; cell-walls often thickened.

Plants stout, up to 12 cm. high; costa with 30-40 lamellae on the upper side.

Lyellia in Fam. 31. POLYTRICHACEAE.

Plants much smaller; costa without or with not more than 8 lamellae on the upper side.

Stems creeping.

Macromitrium in Fam. 13. ORTHOTRICHACEAE.

Stems erect.

Calyptra conic, conic-cylindric, or fusiform.

Costa with lamellae on the upper side.

Pterygoneurum sp. in Fam. 10. TORTULACEAE.

Costa without lamellae.

Calyptra large, fusiform, plicate.

Calymperes in Fam. 9. CALYMPERACEAE.

Calyptra conic-cylindric, subulate-pointed, not plicate.

Genera in Fam. 12. ENCALYPTACEAE.

Calyptra small, low-conic, covering the lid only.

Grimmia sp. in Fam. 11. GRIMMIACEAE.

Calyptra cucullate, often small and fugacious.

Leaves with 5 or 6 long cilia on either margin of the half-clasping basal part.

Bartramiopsis in Fam. 31. POLYTRICHACEAE.

Leaves not ciliate on the margin below.

Capsule urceolate and 8-ribbed when dry.

Anictangium in Fam. 13. ORTHOTRICHACEAE.

Capsule not urceolate and ribbed when dry.

Genera in Fam. 10. TORTULACEAE.

Upper leaf-cells narrow, 8μ wide or less, square to elongate-rectangular, or irregularly elongate.

Cells papillose.

Genera in Fam. 26. BARTRAMIACEAE.

Cells smooth.

Capsule erect.

Annulus none.

Seligeria sp. in Fam. 5. SELIGERiaceAE

Annulus distinct, of 2 rows of pale cells.

Pringleella in Fam. 3. DITRICHACEAE.

Capsule pendent; annulus broad.

Mielichhoferia sp. in Fam. 20. BRYACEAE.

Peristome present.

Peristome-teeth jointed. (Peristome "arthrodonteous.")

Greater part of the leaf formed of 3 or more layers of 2 different kinds of cells, the outer large, porose on the inner surface, and hyaline, the inner small, green, and mostly in 1 row.

Fam. 7. LEUCOBRYACEAE.

Greater part of the leaf formed of 1, or rarely 2, layers of similar cells.

Leaves in 2 rows.

Leaves without a dorsal wing.

Swartzia in Fam. 3. DITRICHACEAE.

Leaves with a dorsal wing.

Fam. 8. FISSIDENTACEAE.

Leaves in 3 or more rows.

Peristome always single, with 16 or 32 teeth, usually without a median line on the outer face, and mostly built up, at least in the lower half, of 3 vertical rows of cells, 1 outer and 2 inner. (Peristome "haplolepideous.")

Neck of the capsule as long as, or longer than the sporangium, stomatose.

Trematodon in Fam. 2. BRUCHIACEAE.

Neck of the capsule short, often scarcely evident; stomata present or absent.

Basal leaf-cells large, hyaline, the transition to the small, green, papillose upper leaf-cells abrupt.

Syrhodon in Fam. 9. CALYMPERACEAE.

Basal leaf-cells usually less strongly differentiated, the transition to the green upper cells not abrupt.

Calyptra large, conic-cylindric, descending to or below the base of the capsule, not plicate nor hairy, not deeply split but often fringed or toothed at the base.

Genera in Fam. 12. ENCALYPTACEAE.

Calyptra small and covering little more than the lid, or distinctly cucullate, or, if large and symmetric, more or less plicate and split on one or more sides.

Peristome-teeth vertically striate on the outer face. Genera in Fam. 6. DICRANACEAE.

Peristome-teeth not vertically striate on the outer face.

Peristome-teeth entire; leaves not hair-pointed.

Costa of homogeneous cells.

Fam. 5. SELIGERACEAE.

Costa of heterogeneous cells.

Genera in Fam. 6. DICRANACEAE.

Peristome-teeth more or less divided, perforate, or vertically grooved.

Costa with a distinct band or bands of stereid-cells.

Leaves papillose, abruptly spreading and subulate-crispate when dry from an obovate, clasping base.

Symblepharis sp. in Fam. 6. DICRANACEAE.

Leaves not abruptly spreading and subulate-crispate when dry from an obovate, clasping base.

Leaves smooth, the upper leaf-cells much elongate or nearly square, never round.

Fam. 3. DITRICHACEAE.

Leaves mostly papillose; the upper leaf-cells somewhat elongate-rhomboidal to hexagonal, or small and round; peristome-teeth often filiform and oblique or twisted, from a distinct basal membrane.

Fam. 10. TORTULACEAE.

Costa without distinct stereid-cells, often of nearly homogeneous cells; peristome never oblique or twisted.

Fam. 11. GRIMMIACEAE.

Peristome mostly double, the teeth with a median line on the outer face, and mostly built up of three vertical rows of cells, 2 outer and 1 inner, or sometimes of 2 outer and 2 inner rows, rarely of only 1 cell at the base of each tooth or throughout. (Peristome "diplolepidious.")

Peristome-teeth not jointed. (Peristome "nematodontous.")

Fruit mostly lateral on the stems, never terminal on the main stems or branches. (Plants "pleurocarpous.")

For continuation, developing these groups, see the pages preceding Fam. 12. ENCALYPTACEAE.



Family 1. ARCHIDIACEAE

By ELIZABETH GERTRUDE BRITTON

Small terrestrial mosses, mostly perennial from the protonema or prostrate stems; branches erect, slender, subapical and flagellate, with small rudimentary leaves. Stem-leaves small, lanceolate-acuminate, rarely ovate, costate, entire or serrate. Perichaetial leaves usually longer and broader, often subulate and serrate. Monoicous or (in one South American species) dioicous. Calyptra inconspicuous, rupturing irregularly, fugacious or remaining at apex or base. Capsule apparently sessile, but borne on a very short seta immersed in a thickened cup-shaped vaginule, small, globose, indehiscent, without columella, lid, or stomata, the spore-sac filled with a few polyhedral spores, the largest of any known in the mosses.

1. ARCHIDIUM Brid. Bryol. Univ. 1: 747. 1827.

Plants rarely more than 1-1.5 cm. high, the first year usually not more than 5 mm., with erect fruiting stems, later bearing subapical, flagellate branches; stems terete, with a central strand and small outer cells; branches either julaceous with erect-appressed, imbricate leaves (in the South American species: *Sclerarchidium*) or slender with distant, lanceolate, smaller leaves (in North American and European species: *Euarchidium*). Perichaetial and comal leaves usually longer and broader, lanceolate-acuminate, or ovate-subulate, often serrate. Capsules 1-8 on each plant, terminal or appearing lateral by successive innovations, or axillary on a short branch, with a short thick seta immersed in the vaginule. Spores few and large, rounded or polyhedral, smooth or finely granular.

Type species, *Phascum alternifolium* Dicks.

Paroicous; leaf-cells up to 27 by 135 μ .

1. *A. alternifolium*

Autoicous.

Antheridia axillary in minute buds with small bracts; leaf-cells 13 by 54 μ .

2. *A. ohioense*.

Antheridia terminal on subapical branches.

3. *A. Hallii*.

4. *A. Donnellii*.

Leaf-cells rhomboidal, 13 by 54 μ .

Leaf-cells linear, 8 by 81 μ .

1. *Archidium alternifolium* (Dicks.) Schimp. Syn. 28. 1860.

Phascum alternifolium Dicks. Pl. Crypt. Brit. 1: 1. 1785.

Pleuridium globiferum Brid. Musc. Recent. Suppl. 4: 10. 1819; Bryol. Univ. 2: 162. 1827.

Phascum globiferum Bruch, Flora 8: 281. 1825.

Archidium phascoides Brid. Bryol. Univ. 1: 747. 1827.

Phascum Bruchii Spreng. Syst. 4: 142. 1827.

Archidium tenerrimum Mitt. Jour. Linn. Soc. 8: 17. 1864.

Archidium Ilescurii Aust. Bull. Torrey Club 6: 144. 1877.

Archidium Ravenelii Aust. Bull. Torrey Club 6: 145. 1877.

Archidium longifolium Lesq. & James, Proc. Am. Acad. 14: 134. 1879.

Plants perennial in close low tufts; stems simple at first, only 5 mm. high, later forming branches among the perichaetial leaves or from the axils of the lower leaves, occasionally 10-15 mm. in length, from which arise the fruiting branches the following year when they have become decumbent and rooting, bearing small bract-like leaves which are lanceolate-channelled and subulate, up to 1.5 mm. long, mostly entire or serrulate, the costa percurrent, the basal cells oblong-rectangular, 18-27 μ wide by 94-135 μ long; perichaetial leaves much longer, 2-2.5 mm. long, the base broader, concave, with more hyaline, elongate basal cells, the margins more or less serrate, and the costa excurrent into a subulate point. Paroicous: antheridia in axils of the upper leaves, naked or with two small bracts; calyptra small, fugacious; capsules 1-3, globose, immersed in the perichaetium, sessile with a very short, thick seta immersed in and easily separating from the swollen cup-shaped vaginule, variable in size, 0.25-0.50 mm. in diameter; walls thin, breaking irregularly; spores few, usually 16, large, 100-

180 μ or at most 200 μ in diameter, irregularly tetrahedral, granular, yellow becoming dark-brown and full of oil-globules, maturing from September to April.

TYPE LOCALITY: Wet ground, England.

DISTRIBUTION: Throughout the eastern United States from New York to Florida; also in northern and central Europe.

ILLUSTRATIONS: Dicks. Pl. Crypt. Brit. *pl. 1, f. 2*; Schwaegr. Suppl. *pl. 10, 205*; Brid. Bryol. Univ. *pl. suppl. 3*; B.S.G. Bryol. Eur. *pl. 7, 637*; A. Gray, Man. ed. 2. *pl. 1* (as *A. ohioense*); G. Roth, Aussereur. Laubm. 1: *pl. 11, f. 3, 7, 11*.

EXSICC.: Drummond, So. Mosses 11, 12 (as *A. phascoides* and var. 2); Aust. Musci App. Suppl. 454; Holz. Musci Acroc. Bor. Am. 76.

2. *Archidium ohioense* Schimp.; (B.S.G. Bryol. Eur. (43:) Archid. ed. 2. 3; hyponym. 1850) C. Müll. Syn. 2: 517. 1851.

Plants seldom more than 5–10 mm. high, branching by repeated subapical innovations, varying from light-yellow to black: leaves narrowly lanceolate-subulate, seldom 1 mm. long; costa excurrent or ending in the subulate awn; margins serrulate; basal cells oblong, becoming rhomboidal or hexagonal, 13 μ wide by 27–54 μ long; perichaetial leaves longer and broader, 1–1.5 mm. long. Autoicous or cladautoicous: antheridia on basal stems or in axillary buds, with 3–4 ecostate bracts: calyptra small, fugacious: capsule sessile in axillary buds, 1–8 on a single plant, seldom more than 25–33 μ in diameter; walls thin, the cells hexagonal, 27 by 54 μ : spores few, 12–24, angled, large, 135–162 μ in diameter, smooth, the contents yellow or brown and filled with oil-globules, maturing from September to April.

TYPE LOCALITY: Harper's Ferry, Virginia.

DISTRIBUTION: In wet fields or bare places in dry soil from Quebec and New York to Minnesota, Florida, and Louisiana.

ILLUSTRATIONS: Sull. Ic. Musc. *pl. 7*; G. Roth, Aussereur. Laubm. 1: *pl. 11, f. 2*.

EXSICC.: Drummond, So. Mosses 13; Sull. Musci Allegh. 213; Sull. & Lesq. Musci Bor. Am. 28; ed. 2. 35; Aust. Musci App. 44; Holz. Musci Acroc. Bor. Am. 2.

3. *Archidium Hallii* Aust. Bull. Torrey Club 6: 145. 1877.

Archidium Hallii minus Ren. & Card. Bot. Gaz. 19: 237. 1894.

Plants gregarious in pale-yellow tufts; stems 3–5 mm. high, with slender subapical branches, often leafless at the base, and capitate: leaves crowded and longer at the apex of the stems, 2–2.5 mm. long, lanceolate-acuminate or subulate; margins occasionally recurved, entire or serrulate, bordered by 1 row of longer, clear cells; costa percurrent or excurrent into a subulate entire awn; basal cells 80–100 μ long by 16–18 μ wide, square or oblong at base, becoming rhomboidal or prosenchymatous above and shorter, 54 by 13 μ . Autoicous: antheridia terminal on more or less elongate branches: capsule terminal or thrust aside by the innovations, 40–60 μ in diameter: spores few, 26–30, large, 189–243 μ in diameter, pale-yellow and smooth, maturing in March and April.

TYPE LOCALITY: Texas.

DISTRIBUTION: Florida, Louisiana, and Texas.

ILLUSTRATION: G. Roth, Aussereur. Laubm. 1: *pl. 10, f. 1, 2*.

4. *Archidium Donnellii* Aust. Bull. Torrey Club 6: 190. 1877.

Archidium ohioense Donnellii Lesq. & James, Man. 50. 1884.

Plants gregarious in yellow masses; stems seldom more than 5 mm. high, branching by subapical innovations, bearing small leaves: fruiting plants usually leafless below or with short rudimentary bracts, capitate, the upper leaves crowded, longer, lanceolate or subulate, up to 2 mm. long; costa terete, percurrent or excurrent into a smooth subulate awn; margins finely serrulate below; basal cells oblong, rectangular, 27–40 μ long by 13 μ wide, soon becoming narrowly prosenchymatous, 67–81 μ long by 8–10 μ wide; alar cells often hyaline. Autoicous: antheridia terminal on a slender branch: capsule immersed, 250 μ in diameter; cells of walls hexagonal, 27 μ in diameter: spores large, angled, 120–164 μ in diameter, maturing in April.

TYPE LOCALITY: Hampden County, Virginia.

DISTRIBUTION: Maryland to South Carolina.

ILLUSTRATION: G. Roth, Aussereur. Laubm. 1: *pl. 11, f. 6*.

EXSICC.: Aust. Musci App. Suppl. 455.

Family 2. BRUCHIACEAE

BY ELIZABETH GERTRUDE BRITTON

Plants usually gregarious, annual or perennial. Stems short and simple or branching at the base. Leaves ovate or lanceolate; costa ending below the apex or excurrent into a subulate awn; margins entire or serrate; basal cells elongate; alar cells not differentiated. Perichaetial leaves usually longer and more pointed. Monoicous or rarely dioicous. Seta short and immersed or elongate and exserted, straight or curved. Calyptra mitrate or cucullate, smooth or papillose. Capsule erect or inclined, pyriform, sharply apiculate, indehiscent without lid or peristome, or dehiscent with a long-beaked lid and a simple peristome of 16 jointed, perforate or bifid teeth; neck short or long, often more than half the length of the capsule, stomatose. Spores rough or pitted.

Calyptra mitrate; peristome none.

Capsule indehiscent, the lid not differentiated or persistent.

Capsule dehiscent, the lid deciduous and annulus present.

Calyptra cucullate; peristome usually present.

1. BRUCHIA.

2. PRINGLEELLA.

3. TREMATODON.

1. BRUCHIA Schwaegr. Suppl. 2¹: 91. 1824.

Saproma Brid. Bryol. Univ. 1: 52. 1826.

Sporledera Hampe, Linnaea 11: 279. 1837.

Protonema more or less persistent. Plants gregarious, usually small but conspicuous by their abundant fruit. Stems simple, with a central strand. Leaves crowded at the apex of the stems, often small and rudimentary below, ovate-lanceolate or subulate; costa stout, ending below the apex or excurrent into a long subulate point, in cross-section with thick outer cells, stereid-cells and few guide-cells; cells smooth or papillose with thickened end-walls. Perichaetial leaves usually longer, broader, and more sheathing. Paroicous or autoicous, rarely dioicous. Antheridia axillary or in basal buds. Seta exserted or short and immersed, straight, curved, or bent. Calyptra mitrate, lobed, smooth or papillose. Capsules ovoid or pyriform, indehiscent, sharply apiculate, the upper half often yellow or red; neck half the length of the capsule, or shorter, with numerous large stomata; lid sometimes slightly differentiated but not deciduous. Spores spinose or warty, reticulate or pitted, maturing in spring and summer.

Type species, *Bruchia vogesiaca* Schwaegr.

Lid not differentiated.

Plants caulescent, 2-8 mm. high; seta as long as or longer than the capsule, exserted, bent or curved; capsule uniformly colored. (EU-BRUCHIA.)

Leaves subulate, the awn serrate, smooth or rough.

Spores spinose, up to 40 μ in diameter.

Paroicous; stems up to 1 cm. long, flexuose; awn smooth.

Autoicous; stems up to 3 mm. long; awn rough.

Spores reticulate, up to 45 μ in diameter; plants paroicous; stems up to 5 mm. long; awn rough.

Leaves subulate, the awn often densely papillose and serrate; spores warty, up to 40 μ in diameter; stems up to 5 mm. long.

Plants acaulescent, 1-4 mm. high; seta immersed, shorter than the capsule.

(MICRO-BRUCHIA.)

Autoicous; upper half of capsule often bright-yellow or red.

Leaves subulate, the awn serrulate, often toothed on the back.

Calyptra smooth; spores reticulate, up to 45 μ in diameter.

Calyptra papillose.

Spores reticulate, up to 32 μ in diameter.

Spores pitted, up to 27 μ in diameter.

Leaves ovate-lanceolate, acute or blunt, not subulate; calyptra smooth; spores pitted, up to 27 μ in diameter.

1. *B. flexuosa*.

2. *B. Sullivanti*.

3. *B. texana*.

4. *B. Donnellii*.

5. *B. Drummondii*.

6. *B. Ravenelii*.

7. *B. Carolinac*.

Costa percurrent into the acuminate apex.

Costa ending below the acute or obtuse apex.

Parioicous; spores papillose, up to 48 μ in diameter.

Lid slightly differentiated but not deciduous; plants caulescent, up to 1 cm.

high; seta longer than the capsule. (PSEUDO-TREMATODON.)

Seta 2-4 mm. long; lid with 2-4 rows of basal cells.

Seta 4-5 mm. long; lid with 4-8 rows of basal cells.

8. *B. brevifolia*.

9. *B. fusca*.

10. *B. Hallii*.

11. *B. Bolanderi*.

12. *B. longicollis*.

1. *Bruchia flexuosa* (Sw.) C. Müll. Bot. Zeit. 5: 99. 1847.

Phascum flexuosum Sw. Adnot. Bot. 75. 1829.

Sporledera Beyrichiana Hampe, Linnaea 11: 279. 1837.

Phascum Beyrichianum Schwaegr. Suppl. 4: pl. 301. 1842.

Bruchia flexuosa nigricans Sull. & Lesq. Musci Bor. Am. 33. 1856.

Bruchia Beyrichiana Sull. Ic. Musc. Suppl. 25. 1874.

Bruchia brevicollis Lesq. & James, Man. 47. 1884.

Plants gregarious; stems usually 2-3 mm. high, occasionally taller, 8-10 mm., slender and flexuose, rarely branching by subapical innovations: lower leaves distant, recurved, about 1 mm. long; upper leaves 1.5-2 mm. long, crowded at the apex of the stems, broader and slightly serrate at the base with lax oblong cells, suddenly contracted into a straight or flexuose point, furrowed above, smooth or slightly roughened on the back by the thickening of the short ends of the cells, apex entire or toothed; costa thick, nearly filling the awn; margins incurved; perichaetial leaves longest, reaching the base of the capsule or beyond. Parioicous: antheridia without paraphyses, 2-3, in the axil of an upper leaf, naked or rarely bracted, occasionally even dioicous and terminal on separate plants: seta erect, bent or curved, 1-2 mm. long; calyptra smooth, lobed: capsule 1-1.5 mm. long, ovoid, yellow or brown when mature, apiculate with a sharp beak, the neck short, 0.5 mm. long, abrupt, stomatose: spores 25-35 μ in diameter, densely spinose, not reticulate, maturing in spring and summer.

TYPE LOCALITY: Pennsylvania.

DISTRIBUTION: On bare ground, old fields, etc., Maine to Florida, Minnesota, and Louisiana.

ILLUSTRATIONS: Schwaegr. Suppl. pl. 101, in part, 301; Sull. Ic. Musc. Suppl. pl. 15.

EXSICC.: Drummond, So. Mosses 14 (as *B. vogesiaca*), in part, 15 (as *B. vogesiaca* var. 2), in part; Sull. & Lesq. Musci Bor. Am. 32, 33; ed. 2. 41, 42; Ren. & Card. Musci Am. Sept. Exs. 1, 1b.

2. *Bruchia Sullivanti* Aust. Bull. Torrey Club 6: 143. 1877.

Bruchia flexuosa Sull. in A. Gray, Man. 645, in part. 1848. Not *B. flexuosa* C. Müll. 1847.

Plants densely gregarious and abundantly fruiting, in light-yellow patches; stems short, almost acaulescent, or taller, 2-3 mm. high: leaves crowded at the summit of the stem, 1-2 mm. long, broadly ovate at the base, abruptly subulate; costa narrower at the base, broader above, nearly filling the subpapillose, secund or flexuose point; margins entire or irregularly serrulate, often incurved; basal cells lax and large, gradually smaller and less regular to the base of the awn; perichaetial leaves longest, equaling or exceeding the seta. Autoicous: antheridia in lateral or basal buds with 2 or 3 long bracts: seta erect or curved, 1-2 mm. long, stout; calyptra apical, nearly smooth, and lobed: capsule pyriform, 1-1.5 mm. long, yellow or brown; beak long, straight; neck about half the length of the capsule, stomatose: spores yellow, densely spinose, 25-40 μ in diameter, rarely larger, maturing in June and July.

TYPE LOCALITY: Closter, New Jersey.

DISTRIBUTION: In wet fields, meadows and broken ground, Maine to Florida, Minnesota, and Louisiana.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 13; G. Roth, Aussereur. Laubm. 1: pl. 13, f. 2, 6 (all as *B. flexuosa*).

EXSICC.: Drummond, So. Mosses 14 (as *B. vogesiaca*), in part; Sull. & Lesq. Musci Bor. Am. ed. 2. 41 (as *B. flexuosa*), in part; Aust. Musci App. 56 (as *B. flexuosa*); Holz. Musci Aeroc. Bor. Am. 1, 52 (as *B. curviseta*).

3. *Bruchia texana* Aust. Bull. Torrey Club 5: 21. 1874.

Bruchia curviseta Lesq. & James, Man. 47. 1884.

Plants gregarious, light-yellow, varying in size at maturity in the same patch, 2-5 mm. high; stems simple, erect, 2-3 mm. high: basal leaves smaller; upper leaves crowded around the base of the seta; perichaetial leaves 1-2 mm. long, the base broad, contracted into a short subulate awn; costa thick, slightly rough on the back, ending below the serrate apex, narrower at the base; cells of the basal lamina oblong and lax below, becoming irregular, crowded above,

and serrulate along the awn. Paroicous: antheridia naked in the axils of the upper leaves: seta 1-1.5 mm. long, erect, or twisted and recurved, exceeding the leaves: calyptra small, lobed: capsule 1-2 mm. long, bright-yellow above, with a long slender beak; neck large, paler, and contracted when dry, abrupt at the base and stomatose, half the length of the capsule: spores yellow, spinosely reticulate, 32-45 μ in diameter, maturing in March and April.

TYPE LOCALITY: Houston, Texas.

DISTRIBUTION: Maryland to Illinois, and southward to Georgia and Texas.

ILLUSTRATIONS: Bull. Torrey Club 21: *pl. 213*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 5* (as *B. Drummondii*); *pl. 14, f. 3* (as *B. brevipes*); *pl. 15, f. 1*.

EXSICC.: Drummond, So. Mosses 15 (as *B. vogesiaca* var. 2), in part; Aust. Musci App. Suppl. 463.

4. *Bruchia Donnellii* Aust. Bull. Torrey Club 6: 144. 1877.

Plants gregarious in light yellowish-green patches; stems erect, 3-4 mm. high, slender, flexuose, leafy to base: leaves curled and recurved, spreading when dry, 1-2 mm. long, abruptly contracted into a rough subulate awn, from a broad, hyaline clasping base; lower cells smooth, clear, the upper ones distinctly papillose by the thickening of the walls; margins more or less recurved and undulate-serrate above. Paroicous: antheridia naked in the axils of the upper leaves: seta exserted, erect or curved, 1.5-2 mm. long: calyptra smooth, lobed: capsule nearly 2 mm. long, orange-colored above, apiculate, the beak straight; neck large, half the length of the capsule, tapering, stomatose: spores 32-40 μ in diameter, warty or papillose, not spinose, maturing in early spring, from February to April.

TYPE LOCALITY: Rosedale, Florida.

DISTRIBUTION: South Carolina to Florida.

ILLUSTRATIONS: Bull. Torrey Club 21: *pl. 214*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 8*.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 41, in part (as *B. flexuosa*); Aust. Musci App. Suppl. 464; Holz. Musci Acroc. Bor. Am. 201 (leaves less papillose than *B. Donnellii* and spores reticulate-spinose, thus approaching *B. texana* Aust.).

5. *Bruchia Drummondii* Hampe; Jaeger, Ber. St. Gall.

Nat. Ges. 1868-69: 97. 1869.

Bruchia brevipes Sull. in A. Gray, Man. ed. 2. 617. 1856. Not *B. brevipes* Hook. 1840.

Bruchia microcarpa Wilson; Jaeger, Ber. St. Gall. Nat. Ges. 1868-69: 98, in part. 1869.

Plants gregarious, glossy, yellow, 3-4 m. high; stems 1 mm. high, decumbent and naked at the base, densely leafy above: perichaetial leaves often 3 mm. long, erect or subsecund, the base broad, less than one third the length of the abruptly contracted slender awn; costa narrow, not occupying quite all of the serrate, channeled awn, occasionally rough on the back; cells narrow, those at the base more lax. Autoicous: antheridia in basal buds: seta short, 0.25-0.50 mm. long: calyptra smooth, lobate: capsule erect, immersed or slightly exserted laterally, one or two in the same perichaetium, 1-2 mm. long, pyriform, apiculate, the upper half bright orange-colored; neck shorter, paler, truncate at the base: spores 35-48 μ , rarely 54-56 μ in diameter, with large reticulations 8 μ in diameter, maturing in March and April.

TYPE LOCALITY: Louisiana.

DISTRIBUTION: Virginia to Georgia and Louisiana, in sandy ground.

ILLUSTRATIONS: Sull. Ic. Musc. *pl. 14*.

EXSICC.: Drummond, So. Mosses 16 (as *B. brevipes*), in part; Sull. & Lesq. Musci Bor. Am. 45; Aust. Musci App. Suppl. 462; Holz. Musci Acroc. Bor. Am. 202.

6. *Bruchia Ravenelii* Wilson; Sull. in A. Gray, Man.

ed. 2. 617. 1856.

Bruchia Schwaegrichenii Jaeger, Ber. St. Gall. Nat. Ges. 1868-69: 97, in part. 1869.

Bruchia microcarpa Wilson; Jaeger, Ber. St. Gall. Nat. Ges. 1868-69: 98, in part. 1869.

Plants gregarious from a brown tomentum, minute, seldom more than 1-2 mm. high; acaulescent: leaves 1-2 mm. long, broader at base, the awn subulate; costa broad, excurrent into a serrate apex, deeply grooved; margins often involute, the basal cells elongate; perichaetial leaves longer. Autoicous: antheridia in basal buds: seta short, 0.25-0.5 mm. long, erect or inclined: calyptra broad at the base, lobed, apiculate and strongly papillose: capsule 1 mm. long, immersed or exserted laterally, ovate-apiculate, yellow or bright orange-red at the

apex; neck short, truncate, stomatose: spores $25-32\ \mu$ in diameter, reticulate with sharp ridges, maturing in February.

TYPE LOCALITY: Santee Canal, South Carolina.

DISTRIBUTION: South Carolina, Alabama, Florida, and Louisiana.

ILLUSTRATIONS: Sull. Ic. Musc. *pl. 16*; G. Roth, Aussereur. Laubm. 1: *pl. 14, f. 5*.

EXSICC.: Drummond, So. Mosses *16*, in part; Sull. & Lesq. Musci Bor. Am. *33b*; ed. 2. *43*; Aust. Musci App. Suppl. *460*.

7. *Bruchia Carolinae* Aust. Bull. Torrey Club 6: 144. 1877.

Bruchia Ravenelii mollis Lesq. & James, Man. 49. 1884.

Bruchia Hampeana Lesq. & James, Man. 49. 1884. Not *B. Hampeana* C. Müll. 1849.

Plants gregarious in brown patches, 1 or seldom 2 mm. high; stems short, 0.5–1 mm. high, naked and radiculose at the base: leaves crowded at the summit, more or less secund, 1 or rarely 2 mm. long, subulate from a broader base; costa channeled, filling the entire or serrulate apex, faintly papillose on the back; basal cells smooth, irregular, the upper ones with thickened walls. Autoicous: antheridia in brown basal buds: seta shorter than the capsules, both immersed, or the capsules occasionally exerted laterally: calyptra broad, lobed, papillose at the apex: capsule 0.5–0.75 mm. long, pyriform, yellow or brown, apiculate, the beak short; neck large, truncate, the stomata immersed, the guard cells covered by the radiating cells around them: spores $21-27\ \mu$ in diameter, pitted, maturing in February and March.

TYPE LOCALITY: Aiken, South Carolina.

DISTRIBUTION: South Carolina and Louisiana.

ILLUSTRATIONS: Bull. Torrey Club 21: *pl. 217*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 10*.

EXSICC.: Drummond, So. Mosses *16* (as *B. brevipes*), in part; Aust. Musci App. Suppl. *461*.

8. *Bruchia brevifolia* Sull. in A. Gray, Man. ed. 2. 617. 1856.

Plants small, 2–3 mm. high, gregarious from a persistent protonema; stems short, 1–2 mm. high, erect or decumbent and subterranean: leaves few, erect or spreading; upper and perichaetial leaves 1–2 mm. long, reaching the base or sometimes the middle of the capsule; base broad, clasping; point acuminate, entire or serrulate; costa thick, ending in the lanceolate apex or percurrent; basal cells oblong. Autoicous: antheridia in basal buds: seta immersed, very short, less than 0.25 mm. long, straight or curved: calyptra smooth and lobed: capsule very large for the size of the plant, 1–2 mm. long, elongate-pyriform, bright orange-colored above and sharply apiculate; neck half the length of the capsule, broad and full of large stomata, truncate at the base: spores yellow and angled, pitted, $21-27\ \mu$ in diameter, maturing in early spring.

TYPE LOCALITY: Louisiana.

DISTRIBUTION: In sandy ground, South Carolina to Texas.

ILLUSTRATIONS: A. Gray, Man. ed. 2. *pl. 1*; Sull. Ic. Musc. *pl. 15*; G. Roth, Aussereur. Laubm. 1: *pl. 14, f. 6*.

EXSICC.: Drummond, So. Mosses *15*, in part; Sull. & Lesq. Musci Bor. Am. *34*; ed. 2. *44*.

9. *Bruchia fusca* E. G. Britton, Bull. Torrey Club 21: 361. 1894.

Plants gregarious, light-yellow or brown, 2–3 mm. high, the protonema more or less persistent, hidden under pebbles and stones; stems short, 1–2 mm. long, naked at the base, erect or decumbent: leaves few, 3–6, erect-appressed, short, 1 mm. long or less, sometimes reaching the base of the capsule, clasping, often broader than long and tricuspidate, entire, or subserrulate with a narrow border of small, retuse cells; apex obtuse, acute or cucullate; costa faint, ending below the apex, or lacking in the lower rudimentary leaves; cells lax at base. Autoicous: antheridia in basal buds: seta short, 0.25–0.50 mm. long, immersed or slightly exerted, straight or curved: calyptra smooth, deeply lobed: capsule large and broad, 1–1.5 mm. long, entirely exerted, ovoid-pyriform, abruptly apiculate, the neck occasionally half the length of the capsule, usually shorter, abrupt or tapering; stomata large; walls of the capsule dense, brown, not transparent: spores $21-27\ \mu$ in diameter, smooth, brown, pitted, maturing in April.

TYPE LOCALITY: In sandy soil, Maryland.

DISTRIBUTION: Maryland and North Carolina.

ILLUSTRATIONS: Bull. Torrey Club 21: *pl. 216*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 11*.

10. *Bruchia Hallii* Aust. Bull. Torrey Club 5: 21. 1874.

Plants 4-5 mm. high, gregarious in light-green patches; stems simple, erect, 2-3 mm. high: leaves erect-appressed, the lower short, the upper not longer than 1 mm., all ovate-lanceolate, entire or serrulate, the costa ending in the acute apex; basal cells larger, very lax, the upper ones fusiform or rhomboidal, the marginal ones elongate, occasionally serrulate; perichaetial leaves broader, clasping. Paroicous: antheridia axillary in the upper leaves: seta stout, erect or curved, 1-1.5 mm. long, exserted: calyptra smooth, lobed, covering only the upper part of the capsule: capsule 1-2 mm. long, brown, pyriform, apiculate, the beak long, straight; shorter, stomatose: spores large, 43-48 μ in diameter, papillose, maturing in February.

TYPE LOCALITY: Houston, Texas.

DISTRIBUTION: Texas.

ILLUSTRATIONS: Bull. Torrey Club 21: *pl. 215*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 7*.

11. *Bruchia Bolanderi* Lesq. Mem. Calif. Acad. 1: 5. 1868.

Plants densely gregarious, pale-green, up to 8 mm. high; stems 1-2 mm. high, simple, or branching by basal innovations: leaves crowded at the base, erect-appressed, short, less than 1 mm. long, lanceolate-subulate; costa broad, vanishing in the slightly serrulate apex; perichaetial leaves much longer, 1-2 mm., base broader, clasping. Autoicous: antheridia terminal in basal buds: seta exserted, erect or flexuose and inclined, 2-4 mm. long: calyptra small, smooth and lobed: capsule 2-3 mm. long, the neck more than half its length, with a slight goiter, stomatose; lid with 2-4 rows of smaller basal cells but not deciduous, the beak slender, 0.5 mm. long: spores warty, 24-27 μ in diameter.

TYPE LOCALITY: Westfall's Meadow, 2400 meters, near Big Tree Grove, Yosemite Valley, Mariposa County, California.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. *pl. 14*; G. Roth, Aussereur. Laubm. 1: *pl. 13, f. 9*.

12. *Bruchia longicollis* D. C. Eaton, Bull. Torrey Club 17: 100. 1890.

Plants gregarious in small clusters in sandy soil or on rotten logs; stems 3-5 mm. high, erect and simple: leaves spreading or recurved, 1.5-2 mm. long, the base broad and clasping, abruptly contracted into a long subulate point, ending in a few sharp teeth; costa thick, almost filling the point; basal cells lax, oblong or hexagonal and hyaline, all smooth; perichaetial leaves longer, 2-3 mm. long, toothed at the apex, the point subulate, the base broader, clasping. Autoicous: antheridia in basal buds: seta exserted, slender, flexuose, erect or inclined, 4-5 mm. long: calyptra lobed: capsule 3-4 mm. long, the neck half its length or more, stomatose; beak 0.5 mm. long, persistent, but with 4-8 rows of smaller hexagonal cells around its base: spores rough-warty, 27-35 μ in diameter, maturing in July.

TYPE LOCALITY: Jackson, New Hampshire.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Bull. Torrey Club 17: *pl. 101*.

This species has only been collected once, in small quantity and was apparently retarded in its development by quantities of fresh water algae which entangled the leaves. It resembles so closely some of the smaller species of *Trematodon* that it might well be referred to that genus; though the cells around the base of the lid are differentiated, it appears not to be deciduous and no trace of a peristome was found.

2. *PRINGLEELLA* Card. Rev. Bryol. 36: 68. 1909.

Plants small, gregarious in loose gravelly soil. Stems short, erect, usually simple. Lower leaves short, second or spreading, the upper ones much longer, erect, overtopping the capsule. Autoicous. Seta short, immersed. Calyptra mitrate lobate. Capsule small, erect, pyriform; neck distinct, stomatose; annulus large; lid deciduous; peristome none. Spores large, rough, papillose, maturing in autumn.

Type species, *Pringleella pleuridioides* Card.

1. *Pringleella pleuridioides* Card. Rev. Bryol. 36: 68. 1909.

Plant gregarious, small, up to 5 mm. high; stems only 2-3 mm. high, simple or branching by basal innovations. Lower leaves spreading or recurved, small, 1-1.5 mm. long, lanceolate,

acute or obtuse; margins entire or slightly serrulate and recurved; costa ending in or below the apex; upper and perichaetial leaves erect, overtopping the capsule, lanceolate-subulate, 2-3 mm. long; costa indistinct at base, broadening into and almost filling the subulate awn, the point canaliculate with incurved margins, entire or with a few teeth at the apex; basal cells linear-oblong, 8μ wide by 54μ long. Autoicous: antheridia terminal on basal buds: seta short, 0.5 mm.: calyptra broad, lobate-mitrate: capsule pyriform, 1 mm. long, with a short, thick, stomatose neck; lid beaked, almost 0.5 mm. long; rim yellow, the cells pale and hyaline; annulus of 2 rows of orange-colored cells, falling in fragments with the lid; walls golden-brown, of irregular thick-walled cells: spores rough, papillose, $27-32\mu$ in diameter, maturing in September.

TYPE LOCALITY: In loose gravelly soil, Sierra de San Esteban, 1500 meters alt., near Guadajajara, Jalisco.

DISTRIBUTION: Known only from the type locality.

EXSICC.: Pringle, Musci. Mex. 10565.

3. TREMATODON Michx. Fl. Bor. Am. 2: 289. 1803.

Plants gregarious, growing on earth in wet places. Stems usually simple and slightly tomentose, terete, with a large central strand. Leaves more or less curved or circinate when dry, with a broad clasping base, tapering into a lanceolate or subulate apex; costa percurrent or excurrent, in section either thin-walled cells only or guide- and stereid-cells present; cells smooth, walls thin. Autoicous, seldom dioicous. Seta slender, exerted, straight or arcuate. Calyptra cucullate. Capsule erect or curved; neck narrower, equal to or longer than the cylindric urn, often with a goiter, stomatose; annulus single or double; lid long-beaked; peristome lacking, or single, the teeth when present 16, entire, perforate, or bifid, vertically striate on the outer surface, papillose on the inner, often bordered. Spores large, rough.

Type species, *Dicranum ambiguum* Hedw.

Peristome present. (EUTREMATODON.)

Capsule with a goiter; peristome exerted on a basal membrane.

Leaves erect or spreading, not circinnate when dry, the margins not revolute; costa filling the awn; peristome-teeth bifid.

Leaves circinnate when dry, the margins revolute; costa not filling the awn; peristome-teeth perforate.

Plants 2-5 cm. high; spores $21-24\mu$.

Plants 1-2 cm. high.

Spores $16-26\mu$.

Spores $18-21\mu$.

Capsule without goiter; peristome deeply inserted.

Peristome lacking. (GYMNOTREMATODON.)

Capsules glossy, often sulcate when dry; annulus persistent.

Capsules not glossy nor sulcate; annulus falling with the lid.

1. *T. ambiguus*.

2. *T. longicollis*.

3. *T. reflexus*.

4. *T. tenellus*.

5. *T. brevicollis*.

6. *T. nitidulus*.

7. *T. Lozanoi*.

1. *Trematodon ambiguus* (Hedw.) Hornsch. Flora 2: 88. 1819.

Dicranum ambiguum Hedw. Descr. 3: 87. 1792.

Trematodon acicularis Kindb. Rev. Bryol. 23: 18. 1896.

Plants gregarious, abundantly fruiting; stems radiculose, simple or branching, 1-2 cm. high; leaves with an erect, clasping base about 1 mm. long, abruptly contracted into a spreading subulate point 1-2 mm. long; costa stout, filling the awn and ending in the serrulate apex; basal cells oblong or hexagonal, clear, the upper ones thick-walled; perichaetial leaves longer, the base 1-2 mm. long, erect, clasping, with lax cells. Autoicous: antheridia terminal on separate branches: seta yellow, variable in length, 1-3 cm. long, erect and twisted or inclined calyptra cucullate: capsule variable, 3-5 mm. long, arcuate, contracted at the neck, the latter 1.5-2 mm. long, stomatose, with a goiter; urn 1-1.5 mm. long, horizontal; lid long-beaked 1 mm. long; annulus compound, of 3-4 rows of hyaline cells; peristome split nearly to the basal membrane, the teeth occasionally perforate, striate and smooth on the outer surface, papillose on the inner: spores rough, warty, $24-35\mu$ in diameter, maturing in late summer and fall.

TYPE LOCALITY: Sweden.

DISTRIBUTION: Newfoundland to Ontario, and southward to Virginia; Alaska; British Columbia; also in Europe.

ILLUSTRATIONS: Hedw. Descr. 3: pl. 36; B.S.G. Bryol. Eur. pl. 96; G. Roth, Eur. Laubm. 1 pl. 10, f. 4.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 96; Aust. Musci App. Suppl. 475; Macoun, Can. Musci 24

2. *Trematodon longicollis* Michx. Fl. Bor. Am. 2: 289. 1803.

Trichodon flexifolius Ren. & Card. Rev. Bryol. 15: 70. 1888

Plants light-yellow, gregarious, very variable in size, 2-5 cm. high; stems simple or branched at base, the sterile branches 10-15 mm. high; fruiting plants shorter, seldom more than 5 mm.; leaves secund or circinnate when dry, 1-3 mm. long, ovate-lanceolate, acuminate or subulate, the basal lamina clasping, the awn spreading or recurved; margins recurved, serrulate; costa not filling the channelled awn, ending below the toothed apex; lower cells oblong, clear, the upper ones quadrate, irregular; perichaetial leaves 4-5 mm. long, with a longer, sheathing, paler base. Autoicous or pseudodioicous: antheridia terminal on a basal branch: seta variable in length, 1-3 cm.: calyptra cucullate, 2-2.5 mm. long; capsule 4-5 mm. long, variable in size and length of the neck; urn 1-2 mm. long; neck 2-4 mm. long, arcuate, with a goiter, stomatose and tapering to the seta; lid rostrate, 1 mm. or more long, its rim serrate; annulus compound, with an orange-colored base, falling in fragments with the lid; capsule-walls striped with brown, with irregular thick-walled cells; mouth bordered by small rounded cells; peristome with an exerted basal membrane of 3-4 rows of thickened cells; teeth irregularly perforate and striate below, paler and papillose above; spores rough, warty, 21-24 μ in diameter, maturing from April to July.

TYPE LOCALITY: In sandy places, Carolina.

DISTRIBUTION: Massachusetts to Florida and Louisiana; Mexico; Cuba; also near Pozzuoli, Naples, growing near the Fumaroli, at Solfatara, Italy.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 19; Schimp. Musci Eur. Novi Trem. pl. 1; G. Roth, Eur. Laubm. 1: pl. 10, f. 2.

EXSICC.: Drummond, So. Mosses 55; Sull. Musci Allegh. 173; Sull. & Lesq. Musci Bor. Am. 75; ed. 2. 95; Aust. Musci App. Suppl. 476; Ren. & Card. Musci Am. Sept. Exs. 20; Holz. Musci Acroc. Bor. Am. 79; Sull. Musci Cub. Wright. 22, in part.

3. *Trematodon reflexus* C. Müll. Syn. 1: 459. 1848.

Trematodon squarrosus C. Müll. Bot. Zeit. 15: 381. 1857.

Trematodon uncinatus C. Müll. Linnaea 38: 628. 1874.

Plants 1-2 cm. high, pale-yellow; stems simple, erect or branching at base, 2-4 mm. high; leaves curled and twisted when dry, reflexed or uncinatate when moist, 1-1.5 mm. long, lanceolate-subulate; base elliptic, clasping, with clear oblong cells; apex linear-subulate, conduplicate or canaliculate, spreading or recurved; margins slightly revolute, entire or slightly sub-serrulate; costa not occupying all of the awn, ending below the rounded toothed apex; perichaetial leaves 3 or 4, erect. Dioicous or autoicous: antheridia terminal on basal branches: seta slender, arcuate or recurved, 5-15 mm. long; calyptra cucullate, 2 mm. long; capsule curved, 3-5 mm. long; neck 2-3 mm. long, twisted, with a small goiter, stomatose; urn 1 mm. long; lid 1 mm. long, rostrate; annulus large, of 3-4 rows of cells, falling in fragments with the lid; peristome red, attached to an exerted basal membrane of 4 rows of cells; teeth perforate or split below, united above, striate on the outer surface, papillose on the inner surface and margins; spores brown, warty, 16-26 μ in diameter, maturing from February to July.

TYPE LOCALITY: Santa Catharina, Brazil.

DISTRIBUTION: Mexico and Guatemala; Jamaica; also in Brazil and Bolivia.

ILLUSTRATIONS: G. Roth, Aussereur. Laubm. 1: pl. 25, f. 4; pl. 27, f. 7.

The differences between this and the preceding and following species are hardly sufficient to separate them; this and the next are probably only smaller forms of *T. longicollis*!

4. *Trematodon tenellus* Schimp.; Besch. Ann. Sci.

Nat. VI. 3: 178. 1876.

Trematodon cubensis C. Müll. Hedwigia 37: 228. 1898.

Plants 1-1.5 cm. high; stems short and simple or branching by basal innovations, 1-2 mm. high; leaves curled and twisted when dry, light-yellow, 1-2 mm. long, linear-subulate from a broader ovate base; costa broad, grooved, not filling the awn, ending in the serrate apex; margins slightly recurved, serrate at the apex only, the upper cells small, quadrate with thick walls, the lower ones oblong, clear; perichaetial leaves longer, 2-3 mm., more sheathing at the base and more abruptly subulate. Autoicous: antheridia in basal buds; seta pale-yellow, 10-15 mm. long, erect or curved; calyptra cucullate; capsules mostly inclined, 5-6 mm. long,

rarely 1 cm.; neck 2–4 mm., with a small goiter and stomatose; urn 2–2.5 mm. long; lid 1.5–2 mm. long; annulus large, red, of 3–4 rows of cells, falling with the lid; peristome red, striolate; basal membrane of 4 rows of cells; teeth unequally perforate or split, the apex pale and slender; spores warty, 18–21 μ in diameter, maturing in spring.

TYPE LOCALITY: On rocks along the road from Sant d'Eau to Camp Jacob, altitude 525 meters, Guadeloupe.

DISTRIBUTION: Cuba (E. G. Britton 5423); Guadeloupe.

ILLUSTRATIONS: G. Roth, Aussereur. Laubm. 1: *pl.* 30, *f.* 4; *pl.* 31, *f.* 2.

EXSICC.: Sull. Musci Cub. Wright. 22, in part; Husnot, Pl. Ant. 194.

5. *Trematodon brevicollis* Hornsch. Flora 2: 88. 1819.

Trematodon ambiguus brevicollis Schwaegr. Suppl. 2: 69. 1823.

Plants gregarious in small tufts; stems short, 2–4 mm. high: leaves erect, appressed carinate, ovate-lanceolate, 1–2 mm. long; costa broad, ending in the short acuminate apex; margins entire, the cells lax, hexagonal or rectangular, with thick walls; perichaetial leaves longer, the apex abruptly mucronate or subulate. Autoicous: antheridia terminal on basal buds: seta stout, 4–6 mm. high, erect, pale-yellow: calyptra cucullate, lobed: capsule 3–4 mm. long, erect or bent at the neck which equals the urn, 1 mm. long; stomata imperfect; lid 1 mm. long, rostrate; peristome short, deeply inserted, dark-red; teeth striate, of 10–12 joints, entire or slightly perforate at the apex; mouth bordered by 4–5 rows of large, lax, dark-brown cells; cells of the walls irregularly thickened; annulus of 2 rows, falling in fragments with the lid: spores brown, rough, 45–60 μ in diameter, maturing in August and September.

TYPE LOCALITY: Near Kals in Tyrol, Austria.

DISTRIBUTION: Greenland; also in alpine regions of Europe and central Asia.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl.* 95; Rab. Krypt.-Fl. 4: *f.* 139–140; G. Roth, Eur. Laubm. 1: *pl.* 10, *f.* 3.

6. *Trematodon nitidulus* Schimp.; Besch. Mém. Soc. Sci. Nat. Cherbourg 16: 161. 1872.

Plants 7–8 mm. high; stems simple, erect, 2–3 mm. high: leaves crowded, twisted and recurved when dry, 1–2 mm. long; base of clear lax cells, the upper cells with thick walls; costa stout, ending in the subulate, serrulate point; margins revolute; perichaetial leaves numerous, crowded at the apex. Autoicous: antheridia in small basal buds: seta straight or arcuate, 3–4 mm. long, pale-yellow: calyptra covering only the beak, lobed: capsule glossy-brown, sulcate when dry, 2–2.5 mm. long; lid rostrate, equaling the urn and neck; peristome none; mouth bordered by 2–3 rows of orange-red cells, forming a persistent tessellated rim or pseud-annulus: spores rough, warty, 21–27 μ in diameter, maturing in September.

TYPE LOCALITY: In a narrow ditch, Rio Blanco, Orizaba, Vera Cruz.

DISTRIBUTION: Vera Cruz.

ILLUSTRATION: G. Roth, Aussereur. Laubm. 1: *pl.* 30, *f.* 3.

7. *Trematodon Lozanoi* Card. Rev. Bryol. 36: 68. 1909.

Plants small, bright-green, not glossy; stems short, up to 5 mm. high, simple: leaves spreading or secund, linear-lanceolate, 3–4 mm. long, entire except at the apex, with a few small teeth; cells oblong-linear, the marginal ones hyaline, with thick walls, often swollen, the basal ones longer and clearer; costa narrow, ending in the apex. Dioicous or pseudo-autoicous: male plants rooting at the base of the female ones, small, 2–3 mm. high: seta 7–8 mm. long, pale-yellow: calyptra large, straw-colored, 2–3 mm. long: capsule 3–5 mm. long, the neck as long as the urn, 1.5 mm., stomatose; lid 1 mm. long, the beak slender; annulus narrow, double, the base orange-colored, falling in fragments with the lid, or more or less persistent; capsule-walls pale-yellow, with narrow hexagonal cells, the mouth not bordered; peristome none: spores brown, 21–27 μ in diameter, papillose or warty on the convex surface with concentric circles on the flat surface, maturing in October.

TYPE LOCALITY: On wet banks, 1800 meters, Etzatlan, Jalisco.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: G. Roth, Aussereur. Laubm. 1: *pl.* 30, *f.* 7.

EXSICC.: Pringle, Musci Mex. 10613.

Family 3. DITRICHACEAE

BY ELIZABETH GERTRUDE BRITTON

Plants gregarious or cespitose, rarely matted together by radicles. Stems slender, erect, branching by innovations or tufted at base. Leaves distichous or crowded in several rows, lanceolate or subulate, rarely ovate, small; costa ending below the apex or excurrent into an entire or serrate point; cells smooth, never papillose, but occasionally with thick walls, rectangular, or prosenchymatous, never enlarged or hyaline at the basal angles. Monoicous or dioicous. Seta immersed or exserted. Calyptra mitrate or cucullate, rostrate. Capsule cleistocarpous or stegocarpous, ovoid or cylindric, usually erect or slightly arcuate, sometimes horizontal, smooth or sulcate when dry; lid small, conic or short-rostrate; peristome, if present, single, with or without a short basal membrane; teeth 16, nodose, papillose, bifid or perforate, occasionally not divided; annulus single or double. Spores small.

Cleistocarpous, the capsules without lid or peristome.

1. PLEURIDIUM.

Stegocarpous, the capsules with a deciduous lid.

Leaves two-ranked; peristome deeply inserted, without a basal membrane.

2. SWARTZIA.

Leaves not two-ranked; basal membrane short.

Teeth regularly bifid with thickened joints.

Leaves subulate, circinate; capsule narrowly cylindric.

3. TRICHODON.

Leaves lanceolate or mucronate; capsule ovoid, strumose, sulcate.

4. CERATODON.

Teeth irregularly split, slender, papillose, the joints not thickened.

Leaves glossy, often secund and subulate.

5. DITRICHUM.

Leaves glaucous with a waxy bloom, not secund.

6. SÆLANIA.

1. PLEURIDIUM Brid. Musc. Recent. Suppl. 4: 10. 1819.

Sporledera Schimp. Coroll. Bryol. Eur. 6, in part. 1855. Not *Sporledera* Hampe, 1837.*

Plants annual or perennial, gregarious or cespitose, in low, dense, usually glossy cushions. Stems simple or branching by subapical innovations; branches short, erect or rarely decumbent. Leaves erect, spreading, or secund, not crisped when dry, small and distant below, longer and crowded above; base ovate or lanceolate; apex long-subulate or short-mucronate, entire or minutely and obscurely serrate; costa broad, indistinctly defined at base, filling most of the awn, usually rough, often toothed on the back, in cross-section showing a central row of 6-12 large guide-cells with narrow stercid-bands above and below, the epidermal cells usually larger and differentiated. Perichaetial leaves longer. Monoicous, either paroicous or autoicous or occasionally heteroicous. Capsules terminal, but appearing lateral, from the thrusting aside by the subapical innovations. Seta very short, immersed. Calyptra cucullate or lobed. Capsule ovoid-apiculate, cleistocarpous, without lid or peristome. Spores brown, rough.

Type species, *Pleuridium alternifolium* Brid. not *Phascum alternifolium* Dicks. Much confusion exists in the original descriptions and citations and except for the "dimidiate calyptra" and citation of only German specimens of *Pleuridium*, it would appear as if the

* The genus *Sporledera* cannot be maintained, as it was founded by Hampe on *Sporledera Beyrichiana*, which evidently is a true *Bruchia*, and, as far as can be determined from immature specimens, is probably a synonym of *B. flexuosa*. Brotherus has recognized four other species as forming with this a subgenus of *Bruchia*, to which genus *S. palustris* does not properly belong, having stomata around the middle of the capsule and no neck. It seems to be more nearly related to *Pleuridium*, in spite of the lobed calyptra, as illustrated in the *Bryologia europaea*.

genus had been founded on English descriptions and figures of *Archidium*, especially as the second species (*P. globiferum* Brid.) undoubtedly belongs to that genus!

Calyptra not lobed; stomata of the capsule-wall basal.

Leaves spreading or secund, lanceolate-subulate. (EUPLEURIDIUM.)

Autoicous, rarely also paroicous; antheridial buds usually axillary to lower leaves; perichaetial leaves abruptly subulate, the awn long and roughly serrate; spores papillose, 21–28 μ in diameter.

Paroicous; antheridia in the perichaetium, with or without bracts.

Perichaetial leaves tapering into a rough subulate awn, the base entire; spores warty, 21–28 μ in diameter.

Perichaetial leaves tapering into a nearly smooth awn, indistinctly serrate.

Base of the perichaetial leaves entire; spores 21–27 μ in diameter, granular.

Base of the perichaetial leaves toothed; spores 27–37 μ in diameter, warty.

Leaves erect-appressed, imbricate, ovate or mucronate. (SCLERASTOMUM.)

Perichaetial leaves mucronate; spores 27–29 μ in diameter, spinose.

Perichaetial leaves subulate; spores 16–18 μ in diameter, rough.

Calyptra lobed; stomata of the capsule-wall median. (SPORLEDERA.)

1. *P. alternifolium*.

2. *P. subulatum*.

3. *P. Bolanderi*.

4. *P. Ravenelii*.

5. *P. Sullivantii*.

6. *P. mexicanum*.

7. *P. palustre*.

1. *Pleuridium alternifolium* Brid. Musc. Recent. Suppl. 4: 10. 1819.

Pleuridium alternifolium germanicum Brid. Bryol. Univ. 2: 162. 1827.

Plants gregarious in dense yellow tufts; stems simple, 2–5 mm. high, or in wet places decumbent and branching by slender basal innovations 10–15 mm. long; leaves distant below, spreading, lanceolate, acuminate, 1–2 mm. long, the upper ones crowded; perichaetial leaves 3–4 mm. long, erect or secund, abruptly subulate from a short ovate entire base, the basal cells clear, oblong; awn serrulate, also toothed on the back; costa filling more than one third of the base and all the apex, in cross-section with 6–10 large central guide-cells and a narrow band of stereid-cells above and below, the epidermal cells thick-walled and regular, the blade usually with only one layer of cells. Heteroicous, either autoicous, or occasionally also paroicous with antheridia axillary in the upper leaves, but generally in axillary buds: seta short, 0.5–1 mm. long; calyptra cucullate; capsule immersed, about 1 mm. long, ovoid, abruptly apiculate, with a broad blunt beak of large lax cells, the walls yellowish-brown, stomatose at base; spores densely papillose, brown, 21–28 μ in diameter, maturing in May and June.

TYPE LOCALITY: Near Borna, Saxony, Germany.

DISTRIBUTION: In old fields on the Atlantic coastal plain from Maine to Florida, west to the plains of Illinois and Kansas; California; also in Europe.

ILLUSTRATIONS: Flora 8¹: pl. 1; Hedw. Descr. 1: pl. 35 (as *Phascum subulatum*); B.S.G. Bryol. Eur. pl. 10; G. Roth, Eur. Laubm. 1: pl. 3, 6; G. Roth, Aussereur. Laubm. 1: pl. 16, f. 3 (as *P. Bolanderi*).

EXSICC.: Sull. Musci Allegh. 212; Sull. & Lesq. Musci Bor. Am. 29; ed. 2. 36; Aust. Musci App. 54, Suppl. 459; Ren. & Card. Musci Am. Sept. Exs. 154b; Holz. Musci Acroc. Bor. Am. 51, 227; Sull. & Lesq. Musci Bor. Am. 30, 39 (both as *P. alternifolium lancastriense*); 31, 37 (both as *P. alternifolium robustum*).

2. *Pleuridium subulatum* (Huds.) Rab. Deutschl.

Krypt.-Fl. 2³: 79. 1848.

Phascum subulatum Huds. Fl. Angl. 397. 1762.

Plants gregarious in bright, glossy, green cushions; stems very short, 2–3 mm. high, simple or branching subapically: basal leaves distant, short, ovate-lanceolate, the upper ones longer, more crowded, erect or subsecund, lanceolate-subulate, the blade in cross-section often of two layers of cells on each side of the costa, also sometimes sporadically toward the margin; awn minutely serrate, and rough on the back; perichaetial leaves 3–5 mm. long, gradually subulate, the base entire, with lax oblong cells, the awn roughly serrate, with margins incurved. Paroicous: antheridia naked in the axils of the perichaetial leaves: seta short; calyptra cucullate; capsule ovoid, 0.75–1 mm. long, apiculate: apex small and blunt, straight or oblique: spores brown, warty, 21–28 μ in diameter, maturing in March and April.

TYPE LOCALITY: England.

DISTRIBUTION: In sandy fields, Massachusetts to Georgia and Alabama.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 32, f. 10; Flora 8¹: pl. 1; B.S.G. Bryol. Eur. pl. 9; Braithw. Brit. Moss-Fl. pl. 14, C; Dixon, Handb. pl. 12, F; Rab. Krypt.-Fl. 4: f. 79.

EXSICC.: Drummond, So. Mosses 7; Sull. Musci Allegh. 31b.

3. *Pleuridium Bolanderi* C. Müll.; Jaeger, Ber. St. Gall.

Nat. Ges. 1868-69: 91. 1869.

Pleuridium stramineum Lesq.; Aust. Bull. Torrey Club 6: 142. 1877.*Pleuridium alternifolium* Howe Ren. & Card. Rev. Bryol. 20: 30. 1893.*Pleuridium Bakeri* Card. & Thér. Bot. Gaz. 37: 363. 1904.

Plants gregarious or scattered in pale-yellow patches; stems simple: leaves lanceolate-subulate, obscurely serrate, 1-2 mm. long; perichaetial leaves longer, 2-4 mm., and broader, spreading or secund, lanceolate-subulate, tapering into a slender nearly smooth awn, channeled with incurved margins, slightly toothed at the apex and occasionally on the back of the costa, the basal cells oblong, large and lax; costa broad, filling almost all the awn and nearly half the base, in cross-section with 9-10 large central ducts, narrow stereid-bands above and below, and large epidermal cells. Paroicous: antheridia few, in small buds in the perichaetium: seta stout, short, 0.40-0.75 mm. long: calyptra cucullate, 0.75 mm. long: capsule immersed or partially exerted, about 1 mm. long, ovoid-apiculate with a sharp-pointed, erect or oblique beak of large lax cells; base abrupt, sparingly stomatose; walls orange-yellow, of thin hexagonal cells: spores yellow, 21-27 μ in diameter, finely granular, not spinose, maturing in March and April.

TYPE LOCALITY: Oakland, California.

DISTRIBUTION: Washington to California.

ILLUSTRATIONS: G. Roth, Aussereur. Laubm. 1: pl. 16, f. 9; Bot. Gaz. 37: pl. 16.

EXSICC.: Sull. & Lesq. Musci Bor. Am. 39, in part.

4. *Pleuridium Ravenelii* Aust. Bull. Torrey Club 6: 142. 1877.

Plants gregarious, yellowish-green, glossy; stems erect, simple, short, only 2-3 mm. high: leaves erect, the upper ones incurved, not secund, the lower crowded, appressed, much smaller, only 1-2 cm. long, ovate-lanceolate, concave, tapering into a subulate, canaliculate or conduplicate awn; margins incurved, obscurely serrulate; costa broad, nearly filling the awn, not toothed on the back and ending in the serrulate apex, in cross-section with 3-5 large ducts, with narrow stereid-bands above and below, and slightly enlarged epidermal cells in the awn, the lamina of one layer of cells; basal cells thick-walled, oblong; perichaetial leaves erect, not secund, 2-3 mm. long, broader at the base, often coarsely and irregularly toothed at the summit of the base where it suddenly contracts into the deeply channeled, slightly serrate awn. Paroicous, either with 5 or 6 naked antheridia in the axils of the perichaetial leaves or with 2 or 3 enclosed in small bracts: seta short, 0.25 mm. long: calyptra minute, less than 0.5 mm. long: capsules immersed, about 0.5-0.6 mm., rarely 1 mm. long, bright-yellow, ovoid, minutely apiculate, the apical cells not enlarged; walls with hexagonal cells; base stomatose: spores yellow, rough, warty, not spinose, 27-37 μ in diameter, maturing from March to June.

TYPE LOCALITY: South Carolina.

DISTRIBUTION: On light sandy soil from Massachusetts to South Carolina.

ILLUSTRATIONS: G. Roth, Aussereur. Laubm. 1: pl. 16, f. 2.

EXSICC.: Aust. Musci App. Suppl. 457.

5. *Pleuridium Sullivantii* Aust. Bull. Torrey Club 6: 142. 1877.

Phascum nervosum Sull. in A. Gray, Man. ed. 2. 616. 1856. Not *Phascum nervosum* Hook. 1820.
Pleuridium nervosum Sull. Ic. Musc. 19. 1864. Not *Pleuridium nervosum* Hook. & Wils. 1854.

Plants bright yellowish-green; stems erect, flexuose, with slender julaceous sterile branches, 5-7 mm. high: leaves all closely appressed, imbricate, 1-1.5 mm. long, ovate-mucronate, often sharply serrate at the apex; costa lacking in the lower leaves, broad and excurrent into a smooth mucronate point in the upper ones; basal cells lax, the upper ones rhomboidal, oblique; perichaetial leaves 1.5-2 mm. long, the costa broadest at the base of the suddenly contracted mucronate awn. Autoicous: antheridia in buds in the axils of the lower leaves: seta short, less than 0.5 mm. long: calyptra cucullate: capsule 1 mm. long, ovoid and minutely apiculate, immersed but conspicuous for its bright orange color, the base stomatose: spores rough, spinose, brown, 27-29 μ in diameter, maturing in March and April.

TYPE LOCALITY: Pennsylvania.

DISTRIBUTION: On thin soil among stones, Connecticut to Florida.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 10; G. Roth, Aussereur. Laubm. 1: pl. 15, f. 5.

EXSICC.: Drummond, So. Mosses 6; Aust. Musci App. Suppl. 458.

6. *Pleuridium mexicanum* Card. Rev. Bryol. 37: 118. 1910.

Plants 7-8 mm. high; stem erect, or flexuose and recurved, simple and radiculose at base; leaves erect, appressed, imbricate, acuminate with the costa percurrent, entire; perichaetial leaves 6-8, longer, 1-2 mm. long, the costa not quite filling the subulate awn; margins incurved and obscurely serrate; point toothed. Antheridia and calyptra unknown: capsule immersed or exserted laterally, 1 mm. long by 0.5 mm. broad, ovoid, sharply apiculate, with large apical cells, brown when mature: spores 16-18 μ in diameter, rough, not spinose.

TYPE LOCALITY: Tres Marias, near Cuernavaca, Morelos, at 2850 meters.

Closely related to *P. Sullivantii* Aust. but differing in the longer subulate perichaetial leaves, sharply apiculate capsule, and smaller, smoother spores.

7. *Pleuridium palustre* (Bruch & Schimp.) B.S.G. Bryol. Eur. (43:) Pleurid. 4. 1850.

Phascum palustre Bruch & Schimp. Mém. Soc. Hist. Nat. Strasb. 2^o: 2. 1835.

Phascum uliginosum Hübener.; Genth. Fl. Nass. 146. 1836.

Astomum palustre Hampe, Flora 20: 285. 1837.

Bruchia palustris C. Müll. Syn. 1: 19. 1848.

Sporolidera palustris Hampe; Schimp. Coroll. Bryol. Eur. 6. 1855.

Protonema more or less persistent. Plants small, gregarious; stems simple or branching by subapical innovations, 1-2 mm., rarely 5-8 mm., high; leaves straight or curved, 1-2 mm. long, subulate from a short, broad, clasping base; costa stout, excurrent into a long, slender, serrate awn, with 2-6 large guide-cells and a few stereid-cells above and below, the dorsal cells smaller than the ventral ones, irregular; blade narrow, the margins incurved, the cells oblong-linear; perichaetial leaves 3-4 mm. long, the awn three times the length of the blade, toothed on the back, the basal cells elongate. Paroicous: antheridia in the axils of the upper leaves: seta very short, scarcely 0.5 mm. long, immersed in the vaginule: calyptra small, 4-5-lobed, or entire: capsule pseudo-lateral by the growth of the terminal innovations, small, up to 1 mm. long, ovoid and broadest at the base, sharply apiculate with a straight slender beak, 0.25 mm. long; cells of the walls thin, hexagonal, with obscure, immersed stomata around the middle or upper half of the capsule: spores brown, warty, 24-30 μ in diameter, maturing in May and June.

TYPE LOCALITY: Near Strasburg, Germany.

DISTRIBUTION: Rare, in wet fields and sandy swamps, Massachusetts to Delaware; not uncommon in central Europe.

ILLUSTRATIONS: B.S.G. Bryol. Eur. pl. 10; Rab. Krypt.-Fl. 4: f. 80.

EXSICC.: Drummond, So. Mosses 8; Sull. & Lesq. Musci Bor. Am. 40; Aust. Musci App. 55.

2. *SWARTZIA* Ehrh.; Hedw. Descr. 2: 72. 1789.

Cynodontium Hedw. Sp. Musc. 57. 1801.

Cynodontium Brid. Musc. Recent. Suppl. 1: 155. 1806.

Distichium B.S.G. Bryol. Eur. (29-30:) Distich. 1. 1846.

Plants caespitose in dense matted tufts. Stems slender, dichotomous, tomentose, in section oval with a large central strand. Leaves distichous, not crowded, the base sheathing, the costa excurrent into a slender, subulate apex, entire or serrulate, in cross-section with median guide-cells, 2 stereid-bands and thickened outer cells, appearing papillose by the thickening of the short cell-walls of the upper half of the leaf, the lower cells clear, linear. Monoicous. Seta long, slender, pale-yellow and twisted. Calyptra cucullate. Capsules cylindric or ovoid, small, erect or horizontal; lid short, conic; peristome single, deeply inserted, divided to the base into 16 filiform or lanceolate teeth, without a basal membrane, split into 2-3 nodose divisions or only perforate; annulus narrow. Spores rough.

Type species, *Swartzia capillacea* Hedw.

Capsules erect, cylindric; leaves very rough at the apex.

Capsules inclined, ovoid; leaves slightly rough at the apex.

1. *S. montana*.

2. *S. inclinata*.

1. *Swartzia montana* (Lam.) Lindb. Musci Scand. 26. 1879.

Bryum montanum Lam. Fl. Fr. 1: 48. 1778.

Mnium capillaceum Sw. Nova Acta Soc. Sci. Upsal. 4: 241. 1784.

Swartzia capillacea Hedw. Descr. 2: 72. 1789.

Distichium capillaceum B.S.G. Bryol. Eur. (29-30:) Distich. 4. 1846.

Plants in dense glossy tufts, 2-8 cm. high; stems slender, matted together with brown tomentum, branching by repeated innovations: leaves 2-3 mm. long, the base erect, sheathing; apex spreading, subulate, slightly serrate, rough with the thick short cell-walls projecting, the basal cells oblong, smooth; perichaetial leaves slightly longer, with a more clasping base. Paroicous or autoicous: antheridia axillary below the perichaetium or in buds below: seta slender, twisted, 0.5-2 cm. long; calyptra cucullate, rostrate: capsule erect, rarely slightly oblique, 1-2 mm. long, ovoid or cylindric, becoming brown when old; annulus of three rows of small cells, falling in fragments with the bordered conic lid; peristome red, irregular, the teeth unequally bifid, slender, more or less imperfect and broken at the joints, smooth: spores minutely roughened, 16-20 μ in diameter, maturing in summer.

TYPE LOCALITY: France.

DISTRIBUTION: Greenland to Alaska, and southward to Nova Scotia, New York, and the Great Lake region, and in the Rocky Mountains to Arizona; also in the Andes and in Europe.

ILLUSTRATIONS: Hedw. Descr. 2: pl. 26; B.S.G. Bryol. Eur. pl. 193.

EXSICC.: Drummond, Musci Am. 122, 123; Sull. & Lesq. Musci Bor. Am. 108; ed. 2. 161; Aust. Musci App. Suppl. 485; Macoun, Can. Musci 57; Holz. Musci Acroc. Bor. Am. 58.

2. *Swartzia inclinata* Hedw. Descr. 2: 74. 1789.

Distichium inclinatum B.S.G. Bryol. Eur. (29-30:) Distich. 5. 1846.

Plants in short dense, dark-green tufts 2-4 cm. high; stems short, matted together and discolored at the base with dark tomentum: leaves closely imbricate at the base, 2-3 mm. long, slightly spreading at the apex, the costa excurrent, forming most of the subulate, slightly roughened point, denticulate at the apex; perichaetial leaves longer and more subulate, with a sheathing base. Autoicous: antheridia in buds below the perichaetium: seta 10-15 mm. long, seldom 20 mm., erect, twisted: calyptra cucullate: capsules inclined, small, 1-1.5 mm. long, ovoid, becoming brown and glossy when dry; annulus narrow, of three rows of cells, falling with the orange-bordered lid; peristome dark-red, the teeth flat, lanceolate, closely jointed, perforate in 2-3 lines, not split, striolate, almost smooth: spores green, rough, 30-45 μ in diameter, maturing in summer.

TYPE LOCALITY: Upsala, Sweden.

DISTRIBUTION: Crevices of damp rocks in moist alpine situations or in peat bogs; less common than the preceding; Greenland, Labrador, Quebec, and Minnesota; in the Rocky Mountains from Utah to Montana; mountains of California; also in Europe.

ILLUSTRATIONS: Hedw. Descr. 2: pl. 27; B.S.G. Bryol. Eur. pl. 194.

EXSICC.: Drummond, Musci Am. 124; Sull. & Lesq. Musci Bor. Am. 108b; ed. 2. 162; Aust. Musci App. Suppl. 486; Macoun, Can. Musci 58; Holz. Musci Acroc. Bor. Am. 178.

3. *TRICHODON* Schimp. Coroll. Bryol. Eur. 36. 1855.

Plants small, gregarious, not cespitose. Stems simple, slender, 3-5-angled, with a central strand. Leaves not crowded, appearing two-ranked but not distichous, sheathing at the base, reflexed, squarrose and subulate at apex, serrulate; costa with guide-cells, stereid-cells, and mamilllose outer cells in the awn; perichaetial leaves very slightly differentiated. Dioicous. Seta long, slender, erect or curved. Calyptra cucullate, rostrate. Capsules narrowly ovoid or cylindric, straight or slightly curved; lid conic-rostrate; annulus large; peristome single, the basal membrane short, the teeth 16, slender, papillose, bifid almost to the base, the joints thickened. Spores smooth.

Type species, *Trichostomum tenuifolium* Schrad.

Seta 10-15 mm. long; capsule narrowly cylindric.
Seta 5-7 mm. long; capsule ovoid-cylindric.

1. *T. tenuifolius*.
2. *T. borealis*.

1. *Trichodon tenuifolius* (Schrad.) Lindb. Oefv. Sv. Vet.-Akad.

Förh. 21: 225. 1864.

Trichostomum tenuifolium Schrad. Jour. Bot. Schrad. 1799: 58. 1799.

Trichostomum cylindricum Hedw. Sp. Musc. 107. 1801.

Ceratodon cylindricus B.S.G. Bryol. Eur. (29-30:) Cerat. 6. 1846.

Trichodon cylindricus Schimp. Coroll. Bryol. Eur. 36. 1855.

Plants small, slender, in light green or golden-brown tufts; stems short, seldom more than 5 mm. high, slender, simple and flexuose. Leaves 1-2 mm. long, the base sheathing, abruptly contracted to a slender recurved and twisted apex, costa excurrent into a rough subulate awn, serrulate on the margins and back by the thickening of the transverse cell-walls; lower cells

smooth, oblong; perichaetium erect, its leaves with a longer sheathing base. Dioicous: antheridia with subulate bracts 3 mm. long: seta slender, 10–15 mm. long, flexuose, glossy, yellow or red: calyptra cucullate: capsule 1–2 mm. long, narrowly cylindric, straight or slightly curved; annulus of three rows of cells falling with the conic, crenate-bordered lid; peristome yellow or red, papillose; teeth slender, unequally divided nearly to the base, enlarged and more or less united at the joints below: spores smooth, 12–14 μ in diameter, maturing from May to August.

TYPE LOCALITY: Germany.

DISTRIBUTION: Wet sandy banks, borders of ditches and fields, western North America from Yukon and British Columbia to Montana, Nevada and Washington; also in northern Europe and Asia.

ILLUSTRATIONS: Hedw. Sp. Musc. *pl.* 24; B.S.G. Bryol. Eur. *pl.* 192.

EXSICC.: Macoun, Can. Musci. 411; Ren. & Card. Musci Am. Sept. Exs. 278.

2. *Trichodon borealis* R. S. Williams, Bryologist 14: 5. 1911.

Plants gregarious in rather lax tufts about 1 cm. high: stems simple or branching by subapical innovations, about 2–3 mm. high, bare and slightly radiculose below: leaves distant and few below, 4–6, crowded upward and appearing distichous, 1–2 mm. long, with an erect-appressed, clasping, oblong-ovate base about 0.5 mm. broad, abruptly contracted into the flexuous circinnate awn; costa broad and distinct at the base, not filling all of the slender, more or less roughened subula, or excurrent, with thickened ends of the short oblong cells projecting; basal cells linear-oblong, smooth; margins slightly crenulate-serrate in the subulate portion, entire below; perichaetial leaves with a broader more abruptly contracted base, clasping the base of the seta and with a longer and more slender awn. Dioicous: male plants 3–5 mm. high, with 1–3 antheridial buds: seta flexuose, straight or curved, 5–7 mm. long: calyptra immature (cucullate?): capsule erect or inclined, ovoid-cylindric, 1–1.5 mm. long; walls brown with irregular, hexagonal, elongate cells; neck with 1 row of stomata; lid conic, blunt or slightly rostrate, of large lax cells, with a narrow rim of smaller cells; annulus large, of 3 rows of cells; mouth bordered by darker smaller cells; peristome slightly papillose except at base; teeth slender, irregularly bifid, nodose, brown, with 8–9 joints: spores smooth, up to 13 μ in diameter, maturing in summer.

TYPE LOCALITY: On damp earth in a small ravine near Dawson, Yukon Territory.

DISTRIBUTION: Known only from the type locality.

ILLUSTRATION: Bryologist 14: *pl.* 2.

4. *CERATODON* Brid. Bryol. Univ. 1: 480. 1826.

Plants caespitose, matted together by radicles, green, not glossy. Stems slender, erect, branching by innovations, in section 3–5-angled. Leaves small, ovate-lanceolate, acuminate or subulate; costa thick, ending in the apex or excurrent; cells rounded or square, smooth or obscurely rough; perichaetium sheathing. Dioicous. Seta purple or yellow, slender, exserted. Calyptra cucullate. Capsule small, erect or horizontal, more or less sulcate, and abrupt at the base; neck strumose; lid conic or rostrate; annulus single or double; peristome single, exserted on a short basal membrane; teeth 16, bifid nearly to the base, nodose, either bordered, with the outer lamellae of the teeth narrower, dark-colored, and less papillose than the inner, or not bordered. Spores small.

Type species, *Mnium purpureum* L.

Seta purple; capsule horizontal, ovoid, sulcate when old.

Seta pale-yellow or red; capsule nearly erect, cylindric.

Capsule 2–3 mm. long; inner perichaetial leaves mucronate.

Capsule 1–2 mm. long; inner perichaetial leaves blunt.

1. *C. purpureum*.

2. *C. stenocarpus*.

3. *C. conicus*.

1. *Ceratodon purpureus* (L.) Brid. Bryol. Univ. 1: 480. 1826.

Mnium purpureum L. Sp. Pl. 1111. 1753.

Dicranum purpurascens Hedw. Sp. Musc. 137. 1801.

Didymodon purpurascens Hook. & Tayl. Musc. Brit. 65. 1818.

Ceratodon purpureus aristatus Aust. Musci App. 22. 1870.

Ceratodon purpureus xanthopus Sull. & Lesq. (Musc. Bor. Am. 29; hyponym. 1865); S. Wats. Bot. Calif. 2: 365. 1880.

Ceratodon heterophyllum Kindb. Ottawa Nat. 5: 179. 1892.

Ceratodon Columbae Kindb. Rev. Bryol. 23: 20. 1896.

Plants perennial, very variable in size and habit; stems usually caespitose, short and crowded, rarely taller, lax and branching, with slender, subapical, dichotomous or fastigiate innovations; leaves incurved and twisted when dry, 1-1.5 mm. long, lanceolate, acuminate or subulate, entire, or serrulate at the apex; margins revolute; costa thick, ending in the apex or excurrent; cells small, rounded or square, the lower ones slightly longer, the alar oblong and slightly decurrent; perichaetium erect, sheathing, its leaves longer, paler, mucronate or often blunt or retuse at the apex. Dioicous: antheridia terminal on more slender plants: seta usually purple, or in certain forms pale-yellow or red, glossy, 1-4 cm. long, erect and twisted: calyptra cucullate: capsule erect, becoming horizontal, sulcate, and usually dark-colored when mature, 1-2 mm., rarely 3 mm. long, glossy and curved when dry; neck abrupt, strumose; lid short, conic or beaked; annulus of 2-4 rows of cells; peristome exerted on a short basal membrane, pale- or dark-red; teeth bifid, closely jointed, dark-brown and trabeculate at the base, paler and papillose above, and incurved when dry, bordered by the paler inner lamellae, thickened and more or less united at the lower joints: spores 10-16 μ in diameter, maturing from April to September.

TYPE LOCALITY: Europe.

DISTRIBUTION: Cosmopolitan. A common and variable species found in many different habitats from sea level to alpine stations and from the tropics to Arctic America, including Alaska and Greenland. Over fifty synonyms and many forms have been recorded, which the most critical European bryologists are disposed to consider only as varieties or subspecies. Comparisons have been carefully made and we find the following atypical North American forms worthy of note:

Plants small; stems short, often julaceous or filiform. (Arctic.)

Leaves erect-appressed, ovate, acute. (Yukon Territory.)

f. *brevifolius*.

Leaves incurved-appressed, ovate or lanceolate, blunt or acuminate. (Agattu and St. Paul Islands, Behring Sea.)

f. *heterophyllus*.

Plants taller, often paler; seta yellow; leaves acute or acuminate. (Xerophytic.)

f. *aristatus*.

Costa excurrent. (Maine to New Jersey.)

Costa percurrent; lid sometimes beaked. (Georgia to Missouri, Montana to New Mexico, Washington to California.)

f. *xanthopus*.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 49; Hedw. Sp. Musc. pl. 31, 35, 36; B.S.G. Bryol. Eur. pl. 189, 190.

EXSICC.: Drummond, Musci Am. 116; Brentel, Musci Frond. Exs. 453; Sull. Musci Allegh. 153; Sull. & Lesq. Musci Bor. Am. 107, 107b; ed. 2. 159, 160; Aust. Musci App. 116, 117; Macoun, Can. Musci 56, 579; Holz. Musci Acroc. Bor. Am. 83, 84, 154; Ren. & Card. Musci Am. Sept. Exs. 19.

2. *Ceratodon stenocarpus* B.S.G. Bryol. Eur. (29-30 :)

Cerat. 4. 1846.

Ceratodon corsicus B.S.G. Bryol. Eur. (43:) Cerat. Suppl. 1. 1850.

Ceratodon vulcanicus C. Müll. Bull. Herb. Boiss. 5: 191. 1897.

Barbula corsica Kindb. Eur. & N. Am. Bryin. 260. 1897.

Plants caespitose, pale or yellowish-green above; stems 1-3 cm. high, branching by subapical innovations; leaves circinate when dry, spreading or recurved when moist, 1.5-3 mm. long, lanceolate, acuminate or subulate, concave; margins revolute, entire or serrate at the apex; costa stout, terete, percurrent or excurrent into a mucronate, serrate point; basal cells oblong, the middle ones square, the upper often broader than long, all smooth with thick walls; perichaetial leaves longer, 3-4 mm. long, with a broader sheathing base, acuminate or abruptly contracted into a narrower, subulate, serrulate point, the basal cells lax, hyaline, linear. Dioicous: seta slender, pale-yellow or rufous, 1-2 cm. long; calyptra cucullate: capsule erect or inclined, straight or curved, rugose, plicate, narrowly cylindric, 2-3 mm. long; neck short, slightly strumose; lid conic or slightly rostrate, red and bordered, 0.5 mm. long; annulus compound, falling in fragments with the lid; mouth bordered by irregular cells; walls pale-yellow or darker and striped with brown; peristome erect, exerted on a short, pale and thickened basal membrane; teeth with few, 5-6, elongate basal joints, slightly trabeculate, narrowly if at all bordered, split almost to the base into two slender, pale, very papillose segments, not united nor much thickened at the joints: spores nearly smooth, pale-yellow, 8-10 μ , rarely 13-16 μ in diameter, maturing in October and November.

TYPE LOCALITY: Neilgherry Hills, India.

DISTRIBUTION: Mexico to Panama; southward in the Andes to Bolivia; also in Corsica, Portugal, and tropical Africa and Asia.

ILLUSTRATION: B.S.G. Bryol. Eur. pl. 191.

EXSICC.: Pringle, Musci Mex. 10555.

3. *Ceratodon conicus* (Hampe) Lindb. Musci Scand. 27. 1879.

Trichostomum conicum Hampe; C. Müll. Syn. 1: 575. 1849.

Ceratodon minor Aust. Bot. Gaz. 2: 89. 1877.

Ceratodon purpureus Gräfi Schlieph.; Limpr. in Rab. Krypt.-Fl. 4¹: 487. 1887.

Plants small, 5–10 mm. high, forming low, dense tufts; stems short, seldom more than 5 mm. long, branching by subapical innovations; leaves erect-appressed, not circinate when dry, spreading, not recurved when moist, gradually larger and crowded upward, 1–1.5 mm. long; base ovate-lanceolate, acuminate; margins strongly revolute; costa stout, excurrent into a canaliculate smooth or serrulate awn; cells of the base all square, laxer near the costa, the upper ones irregular; perichaetial leaves few, erect, sheathing, only about 1 mm. long, the basal cells more hyaline, the costa excurrent or in the two inner, convolute leaves, ending below the blunt apex. Dioicous: seta pale-red or yellow, 10–15 mm. long, erect; calyptra cucullate; capsule erect, cylindric, 1.5–2 mm. long, and slightly unequal at base; neck slightly strumose; walls pale-yellow or brown and striped, slightly sulcate when dry; lid conic, red, bordered; annulus falling in fragments or rarely persistent; peristome short, exerted on a short membrane; teeth with few nodose basal joints, and slender and papillose pale divisions with an obscure or sometimes scarcely perceptible border: spores smooth, 8–10 μ in diameter, maturing in May and June.

TYPE LOCALITY: Flegesen, near Hameln, northern Germany.

DISTRIBUTION: On walls and waste grounds, rare in North America, known only from a few stations in Minnesota, Idaho, Washington, British Columbia, and Alaska; also in Europe and Asia.

ILLUSTRATIONS: Braithw. Brit. Moss-Fl. pl. 26, E; Rab. Krypt.-Fl. 4: f. 153; Dixon, Handb. pl. 13, W.

EXSICC.: Macoun, Can. Musci 452.

5. *DITRICHUM* Timm, Fl. Megapol. 216. 1788.

Leptotrichum Hampe, Linnaea 20: 74. 1847.

Plants gregarious or caespitose. Stems short, sparingly branched. Leaves not distichous, lanceolate or subulate, entire or serrate; costa broad, ending in the apex, or excurrent, in cross-section with guide-cells in two rows; cells rectangular at the base, not enlarged at the basal angles, narrow above and smooth or with slightly pitted walls; perichaetial leaves slightly longer or sheathing. Dioicous or monoicous. Seta slender, erect, twisted. Calyptra cucullate. Capsules erect, ovoid or cylindric, smooth or slightly sulcate; lid conic, rarely rostrate; peristome generally exerted on a short basal membrane, erect or slightly twisted; teeth 16, bifid nearly to the base, slender, nodose, smooth or papillose; annulus single or double. Spores small, smooth or rough.

Type species, *Trichostomum pusillum* Hedw.

Dioicous.

Fruiting plants seldom more than 3 cm. high, gregarious; stems usually simple.

Leaf-margins slightly revolute, serrulate.

Peristome-teeth more or less connate or even perforate at base.

Leaves secund, subulate; perichaetium not sheathing.

Leaves erect-appressed, lanceolate; perichaetium sheathing.

Peristome-teeth not connate or perforate.

Leaf-margins not revolute, entire.

Fruiting plants usually more than 3 cm. high, caespitose; stems usually branched.

Leaves 1–3 mm. long; perichaetial leaves gradually subulate.

Leaves 5–7 mm. long; perichaetial leaves abruptly subulate.

Paroicous; plants 1–3 cm. high; seta sometimes 4 cm. long.

Awn serrulate, as long as the leaf-base; spores rough, 14–18 μ in diameter.

Awn entire, 4–6 times as long as the leaf-base; spores smooth, 10–16 μ in diameter.

Autoicous; stems less than 1 cm. high; seta 1–3 cm. long.

Awn nearly entire, 4–6 times as long as the leaf-base; spores rough, 21–27 μ in diameter.

Awn serrate, about as long as the leaf-base; spores smooth, 8–10 μ in diameter.

1. *D. pusillum*.

2. *D. lineare*.

3. *D. ambiguum*.

4. *D. heteromallum*.

5. *D. flexicaule*.

6. *D. giganteum*.

7. *D. pallidum*.

8. *D. rufescens*.

9. *D. Schimperii*.

10. *D. montanum*.

1. *Ditrichum pusillum* (Hedw.) Timm, Fl. Megapol. 216. 1788.

Trichostomum pusillum Hedw. Descr. 1: 74. 1787.

Mnium tortile Schrad. in J. F. Gmel. Syst. Nat. 2: 1328. 1791.

Trichostomum tortile Schrad. Samml. Krypt. Gew. 1: 12. 1796.

Trichostomum tenue Hedw. Sp. Musc. 107. 1801.

Leptotrichum pusillum Hampe, *Linnaea* 20: 74. 1847.

Leptotrichum tortile C. Müll. Syn. 1: 454. 1848.

Ditrichum tortile Brockm. Laubm. Meckl. 74. 1869.

Leptobarbula berica Macoun, Cat. Can. Pl. 6: 49. 1892. Not *L. berica* Schimp. 1876.

Plants variable in size and development, yellowish-green or black when old, gregarious; stems mostly simple, erect, 1-2 cm. high; branches subapical: leaves small, erect and lanceolate on the branches, often twisted, spreading or reflexed on the main stems, 1-3 mm. long; margins plane or revolute, often doubly serrulate; costa broad, percurrent or excurrent into a subulate point, channeled and denticulate at the apex; basal cells oblong, clear, the upper ones rectangular with thick walls; perichaetial leaves longer and broader at the base, not sheathing, the point subulate. Dioicous: antheridia terminal on plants about 1 cm. high: seta variable in length from 5-15 mm., red, twisted: calyptra cucullate: capsules very variable in size, 0.5-1.5 mm. long, ovoid to cylindric; walls of rectangular irregular cells; neck short, stomatose; lid conic-rostrate, bordered; annulus single, small, falling in fragments; peristome red, the basal membrane short, the teeth bifid, papillose, slightly twisted or erect, their joints thick: spores smooth, yellow, 10-14 μ in diameter, maturing in autumn.

TYPE LOCALITY: Leipzig, Germany.

DISTRIBUTION: Common on clay and sandy banks, in ditches and pits, and along roadsides, from Newfoundland to Ontario, and south to Florida and Louisiana; doubtfully reported from California; also in Europe, Asia, and Africa.

ILLUSTRATIONS: Hedw. Descr. 1: pl. 28; Hedw. Sp. Musc. pl. 24; Schwaegr. Suppl. pl. 35.

EXSICC.: Drummond, Musci Am. 118; Drummond, So. Mosses 57-59; Sull. Musci Allegh. 175; Sull. & Lesq. Musci Bor. Am. 103; ed. 2. 152, 153; Aust. Musci App. 118; Macoun, Can. Musci 65, 486.

2. *Ditrichum lineare* (Sw.) Lindb. Acta Soc. Sci.

Fenn. 10: 108. 1871.

Didymodon lineare Sw. Adnot. Bot. 100. 1829.

Trichostomum vaginans Sull. Musci Allegh. 176. 1845.

Leptotrichum vaginans Schimp. Syn. ed. 2. 140. 1876.

Trichostomum nodulosum Aust. Bull. Torrey Club 6: 73. 1876.

Plants gregarious, 1-2 cm. high; stems erect, simple or branching by slender innovations 1-1.5 cm. long; leaves erect, appressed, particularly on the branches, lanceolate, blunt or cucullate; margins entire or serrulate, plane or very slightly revolute; costa stout, ending below the apex in the lower leaves, excurrent in the upper; perichaetial leaves sheathing, the apex subulate, or short-cuspidate, serrulate, the base broad, the cells linear, not hyaline nor quadrate. Dioicous: antheridia terminal in buds on slender plants: seta 1-3 cm. long, erect, twisted in two directions, rufous, slender: capsule erect, smooth, almost cylindric; lid short, blunt or conic-rostrate with a serrate edge, the cells straight; mouth small and bordered; annulus large, double, falling with the lid; peristome deeply inserted; teeth divided unequally at the base into two slender, finely papillose, nodose segments, smooth when immature: spores 10-12 μ in diameter, nearly smooth, maturing in the autumn.

TYPE LOCALITY: Lancaster, Pennsylvania.

DISTRIBUTION: On clay soil, roadsides, rarely on rocks; Prince Edward Island; New Hampshire and Vermont to North Carolina and Missouri; also in Europe.

ILLUSTRATIONS: Sull. Ic. Musc. pl. 28; Rab. Krypt.-Fl. 4: f. 155.

EXSICC.: Drummond, Musci Am. 60, 61; Sull. Musci Allegh. 176; Sull. & Lesq. Musci Bor. Am. 104; ed. 2. 154; Aust. Musci App. 119; Macoun, Can. Musci 386; Holz. Musci Acroc. Bor. Am. 311 (as *D. heteromallum*).

3. *Ditrichum ambiguum* Best, Bull. Torrey Club 20: 117. 1893.

Plants gregarious; stem about 1 cm. high, angular, the central strand distinct: leaves pale-yellow, shining, crispate when dry, spreading, arcuate, lanceolate-acuminate or subulate, 2-3 mm. long, clasping at the base, canaliculate above, toothed at the apex; margins plane and entire below, above sinuate-serrulate, thickened, revolute and bistratose; perichaetial leaves larger, not abruptly narrowed above the long sheathing base; leaf-cells thick-walled, oblong-rectangular below, narrowly oblong-linear above; costa percurrent, papillose, dentate on the upper third. Dioicous: seta 1-2 cm. long, red, erect and twisted: calyptra cucullate: capsule narrow, cylindric, straight or slightly curved, 1.5 mm. long; cells of walls not uniform, oblong-rectangular, rounded and thick-walled, with two rows of smaller ones about the mouth; lid conic-rostrate, blunt, one third to one half the length of the urn; peristome red; base

membrane rather narrow; teeth long, equal, bifid to the base, the segments filiform, papillose, slightly flattened and more or less nodose below; annulus large, of 2-3 rows of cells: spores smooth, 9-11 μ in diameter, maturing in winter.

TYPE LOCALITY: Mason County, Washington.

DISTRIBUTION: Washington and Oregon.

EXSICC.: Holz. Musci Acroc. Bor. Am. 137.

4. *Ditrichum heteromallum* (Hedw.) E. G. Britton.

Weisia heteromalla Hedw. Descr. 1: 22. 1787.

Didymodon homomallus Hedw. Sp. Musc. 105. 1801.

Trichostomum homomallum Bruch & Schimp. in B.S.G. Bryol. Eur. (18-20:) Trichost. 16. 1843.

Ditrichum homomallum Hampe, Flora 50: 182. 1867.

Trichostomum heteromallum Lindb.; Aust. Bull. Torrey Club 6: 74. 1876.

Plants gregarious or rarely caespitose; stems usually simple, only 5-10 mm. high, rarely branching and taller, 4-5 cm. high, with red tomentum: leaves spreading, twisted or secund when dry, 1-2 mm., rarely 3 mm. long, the apex subulate from a short ovate base; margins entire or rarely subserulate at the apex, not revolute; costa broad, flat, not channelled, excurrent into the long slender awn, toothed at the apex; lower cells narrow, linear, not much thickened, the upper ones rectangular; perichaetial leaves clasping at the base, abruptly long-subulate. Dioicous: seta 1-2.5 cm. long, dark-red; capsule also dark-red, erect, cylindric, becoming ovoid, 1-1.5 mm. long; walls with small irregular hexagonal cells; lid small, conic, blunt, the cells straight, small, hexagonal; the border dentate; annulus large, double, of two rows of cells, falling in fragments; mouth small, bordered by darker flaring cells; peristome long and slender, fugacious, with a short basal membrane; teeth bifid to the base or united below at the joints, rarely not divided, red or brown, smooth or slightly roughened: spores yellow, smooth, 12-14 μ in diameter, maturing in fall and winter.

TYPE LOCALITY: Saxony, Germany.

DISTRIBUTION: Rare in mountain regions of North America from the west side of the Rocky Mountains to Alaska; reported from the White Mountains, New Hampshire; also in Europe.

ILLUSTRATIONS: Hedw. Descr. 1: pl. 8; Hedw. Sp. Musc. pl. 23; B.S.G. Bryol. Eur. pl. 181.

EXSICC.: Drummond, Musci Am. 119; Macoun, Can. Musci 451.

5. *Ditrichum flexicaule* (Schwaegr.) Hampe, Flora 50: 182. 1867.

Cynodontium flexicaule Schwaegr. Suppl. 1^a: 113. 1811.

Trichostomum flexicaule Bruch & Schimp. in B.S.G. Bryol. Eur. (18-20:) Trichost. 15. 1843.

Trichostomum flexicaule densum Bruch & Schimp. in B.S.G. Bryol. Eur. (18-20:) Trichost. 15. 1843.

Leptotrichum flexicaule Hampe; C. Müll. Syn. 1: 449. 1848.

Leptotrichum flexicaule densum Schimp. Syn. 145. 1860.

Ditrichum flexicaule densum Braithw. Brit. Moss-Fl. 1: 101. 1881.

Distichum Macounii C. Müll. & Kindb.; Macoun, Cat. Can. Pl. 6: 40. 1892.

Leptotrichum flexicaule brevifolium Kindb.; Macoun, Cat. Can. Pl. 6: 46. 1892.

Ditrichum brevifolium Paris, Index Bryol. 391. 1895.

Ditrichum flexicaule brevifolium Barnes, Bull. Univ. Wisc. Sci. 1: 273. 1897.

Ditrichum elatum Kindb. Eur. & N. Am. Bryin. 181. 1897.

Plants variable, either lax or densely tufted and matted with brown tomentum; stems often 8-10 cm. high, erect and crowded or lax and flexuose; branches slender, often 1 cm. long; leaves erect or spreading, twisted, seldom secund, 1-3 mm. long, the base broader, clasping, tapering into a slender, concave awn, the apex entire or slightly toothed; basal cells rounded or irregular, often rectangular; alar cells occasionally larger, rarely pitted or elongate next the broad costa; perichaetial leaves longer, broader and hyaline at the base, tapering into a slender, subulate, entire awn. Dioicous: seta 1-2 cm. long, red below, paler above and twisted; capsule erect, 2-2.5 mm. long, broadest at the base; mouth small, bordered by darker cells; lid small, conic; margin serrate; annulus large, of 3 rows of cells; peristome red at the base, paler above, the basal membrane short; teeth slender, papillose, bifid to the base, fragile and fugacious: spores smooth, 8-12 μ in diameter, maturing in spring.

Ditrichum flexicaule densum has shorter densely tomentose stems with smaller leaves, and *D. flexicaule brevifolium* is a still smaller plant with short acute not subulate leaves, entire with small quadrate basal cells.

TYPE LOCALITY: Switzerland.

DISTRIBUTION: Woods and banks, alpine and subarctic regions; Greenland and Nova Scotia to Minnesota, British Columbia, and Alaska; also in northern Europe, Asia, and Africa.

ILLUSTRATIONS: Schwaegr. Suppl. pl. 29, f. 1; B.S.G. Bryol. Eur. pl. 180.

EXSICC.: Drummond, Musci Am. 126; Macoun, Can. Musci 461, 490; Holz. Musci Acroc. Bor. Am. 12.

6. *Ditrichum giganteum* R. S. Williams, Bull. N. Y. Bot.

Gard. 2: 113. 1901.

Didymodon flexicaule sterile De-Not. Syll. Musc. 197. 1838.*Leptotrichum flexicaule sterile* De-Not. Atti Univ. Genova 1: 515. 1869.*Leptotrichum flexicaule longifolium* J. E. Zett. Nova Acta Soc. Sci. Upsal. III. 7: 14. 1869.*Trichostomum flexicaule longifolium*, J. E. Zett. Oefv. Sv. Vet.-Akad. Förh. 34: 71. 1877.*Ditrichum flexicaule longifolium* I. Hagen, Tromsø Mus. Aarsh. 21-22: 40. 1899.

Plants often 10-15 cm. high, in lax yellowish-green cushions; stems branching by slender apical innovations, matted with brown tomentum below; leaves not crowded, erect or secund, twisted when dry, 5-7 mm. long, lanceolate, subulate, the awn canaliculate with incurved serrulate margins, the apex serrate; costa broad and indistinct at the base, excurrent and often rough on the back; basal cells narrowly rectangular, the marginal ones linear, with thin walls, wider, thick-walled and generally pitted near the costa, becoming short, irregular or square in the middle of the leaf and elongate at the apex; perichaetial leaves abruptly truncate and serrate, with a short rough subulate point. Dioicous: antheridia on slender plants with brown bracts; seta slender, pale-red, twisted, 3-3.5 cm. long; capsule erect or inclined, 2-3 mm. long, ovoid-cylindric, the neck tapering, stomatose; mouth small, bordered with 3-4 rows of elongate cells; annulus large, of 3 rows of cells falling with the conic lid; peristome without a basal membrane; teeth flat, contracted at the joints, papillose, mostly entire and not bifid; spores 11-12 μ in diameter, smooth, maturing in autumn.

TYPE LOCALITY: Columbia Falls, Montana.

DISTRIBUTION: On gravel banks and sand bars and in crevices of rocks, in the Rocky Mountains from Montana to Yukon Territory; around the Great Lakes, in Minnesota and Michigan; also in Europe, from Scandinavia to Italy in the mountains, usually sterile.

ILLUSTRATIONS: Schwaegr. Suppl. pl. 29, f. 1a; Bull. N. Y. Bot. Gard. 2: pl. 15.

EXSICC.: Drummond, Musci Am. 125; Macoun, Can. Musci 66; Spruce, Musci Pyr. 197; Wilson, Musci Brit. 111.

7. *Ditrichum pallidum* (Schreb.) Hampe, Flora 50: 182. 1867.*Bryum pallidum* Schreb. Spic. Fl. Lips. 80. 1771.*Trichostomum pallidum* Hedw. Descr. 1: 71. 1787.*Leptotrichum pallidum* Hampe; C. Müll. Syn. 1: 451. 1848.*Ditrichum rhynchostegium* Kindb. Rev. Bryol. 37: 14. 1910.

Plants caespitose, bright glossy yellow; stems short, 3-7 mm. high, simple or branched; leaves homomallous, twisted and recurved when dry, 3-5 mm. long, lanceolate-subulate; costa broad, excurrent into a long serrulate apex; basal cells oblong or hexagonal, large and clear, up to 10 μ long, the upper cells linear, obscure; perichaetium not sheathing. Paroicous: antheridia in buds below the perichaetium; seta variable, 1-4 cm. long, slender, light-yellow, glossy, twisted; capsules erect or inclined, ovoid-cylindric, 1-3 mm. long, sulcate when dry; neck truncate; lid short, conic, blunt; annulus falling in fragments; mouth small, bordered; peristome brown, slightly twisted; basal membrane short; teeth 16, irregularly bifid, jointed, papillose; spores rough, 14-18 μ in diameter, maturing from February to June.

TYPE LOCALITY: Near Leipzig, Germany.

DISTRIBUTION: Fields and grassy banks, common in eastern North America from Maine and Ontario to Florida, Texas, and Oklahoma; also in Europe and Asia.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 49, f. 57; Hedw. Descr. 1: pl. 27; B.S.G. Bryol. Eur. pl. 183.

EXSICC.: Drummond, So. Mosses 56; Sull. Musci Allegh. 174; Sull. & Lesq. Musci Bor. Am. 105; ed. 2. 155; Sull. Musci App. 120; Ren. & Card. Musci Am. Sept. Exs. 22; Macoun, Can. Musci 67; Holz. Musci Acroc. Bor. Am. 14.

8. *Ditrichum rufescens* (Hampe) Broth. in E. & P. Nat.Pfl. 1³: 300. 1901.*Mnium strictum* Sw. Prodr. 139. 1788. Not *Ditrichum strictum* Hampe, 1867.*Trichostomum strictum* Sw. Fl. Ind. Occ. 1761. 1806.*Trichostomum pallidum strictum* Schwaegr. Suppl. 2: 177. 1824.*Leptotrichum rufescens* Hampe, Linnaea 31: 521. 1862.*Cynodontium strictum* Mitt. Jour. Linn. Soc. 12: 42. 1869.*Cynodontium rufescens* Mitt. Jour. Linn. Soc. 12: 44. 1869.*Leptotrichum mexicanum* Schimp.; Bosch. Mém. Soc. Sci. Nat. Cherbourg 16: 174. 1872.*Leptotrichum capillifolium* Schimp.; Jaeger, Ber. St. Gall. Nat. Ges. 1871-72: 388; hyponym. 1873.*Leptotrichum pseudo-rufescens* C. Müll. Bull. Herb. Boiss. 5: 554. 1897.

Plants densely gregarious, forming soft, matted, yellowish-green tufts; stems 1-3 cm. high, tomentose at the base, densely leafy above; leaves not secund, twisted when dry, 3-5 mm. long, lanceolate-subulate, from a short clasping base; margins incurved, subserrulate or entire; costa very broad, channeled and grooved, filling three fourths of the base and nearly all of the smooth tubular awn, ending below the denticulate apex; basal cells linear, porose, up to 50 μ long; perichaetial leaves with a longer, broader, clasping base. Paroicous: antheridia just below the perichaetium in buds: seta pale-yellow or rufous and slender, 1-3 cm. high: calyptra 3 mm. long, cucullate: capsule erect or slightly inclined, smooth or slightly furrowed when dry, symmetric, ovoid-cylindric, 1.5-3 mm. long; neck short, abrupt, stomatose; lid 0.5-0.75 mm., conic-rostrate, bordered; annulus simple, narrow; mouth small, bordered by 2-3 rows of red cells; peristome slightly twisted; basal membrane short; teeth irregularly bifid, jointed, nodose, papillose: spores smooth or nearly so, 10-16 μ in diameter, maturing from April to June.

TYPE LOCALITY: Cipacon, Andes of Bogota, Colombia, alt. 2500 meters.

DISTRIBUTION: On shady banks in mountains from Mexico to Colombia; Jamaica, 1500-2100 meters.

ILLUSTRATIONS: Schwaegr. Suppl. pl. 123.

9. *Ditrichum Schimperi* (Lesq.) Paris, Index Bryol. 391. 1895.

Leptotrichum Schimperi Lesq. Mem. Calif. Acad. 1: 9. 1868.

Plants gregarious, yellow, glossy; stems short, erect, simple, 3-5 mm. high: leaves crowded, secund, 3-7 mm. long with a long, slender, smooth, subulate point, the base short; costa broad, nearly filling the awn, with a broad band of stereid-cells below and one row of ducts above; apex serrate; margins incurved, entire or faintly serrulate; basal cells oblong, clear, the marginal and apical ones linear, obscure; perichaetial leaves with a long, slender, falcate awn. Autoicous: antheridia in several small buds below the perichaetium: seta pale-yellow, 1-2 cm. long: calyptra large, pale and twisted: capsules erect or inclined, 2-3 mm. long, striped with brown and slightly furrowed when dry, narrowly ovoid-cylindric with a short stomatose neck; lid rostrate, the margin serrate; annulus narrow, of 2 rows of cells, falling with the lid; peristome short, erect, not twisted, orange-red and papillose; basal membrane slightly exserted; teeth slender, irregularly bifid, perforate or split: spores large, 21-27 μ in diameter, brown, rough, maturing in June.

TYPE LOCALITY: Coast Ranges near Mendocino City, California.

DISTRIBUTION: On clay soil and roadside banks, from California to Vancouver Island.

ILLUSTRATIONS: Sull. Ic. Musc. Suppl. pl. 24.

EXSICC.: Holz. Musci Acroc. Bor. Am. 310.

10. *Ditrichum montanum* Leiberg, Bull. Torrey Club 20: 112. 1893.

Plants caespitose; stems short, 5-10 mm., rarely 1-2 cm. high, branching: leaves erect or curved, 2-3 mm. long, lanceolate-subulate, canaliculate; costa broad, ending below the toothed apex; margins incurved, the cells double, subserrulate; blade narrow, of few rows of rectangular cells above, of square or oblong and thick-walled ones below; perichaetium lax and sheathing at the base. Autoicous: antheridia terminal on basal branches: seta pale-yellow, 15-25 mm. long, twisted: calyptra one third as long as the capsule: capsule 2-3 mm. long, erect, ovoid, the base broad; lid rostrate; annulus double; basal membrane short; teeth papillose, bifid, articulate, brown; mouth narrow, bordered by irregular dark cells; walls thin, yellow with linear-oblong cells: spores 8-10 μ in diameter, smooth.

TYPE LOCALITY: Idaho.

DISTRIBUTION: On broken soil and roots of trees, in the mountains of Idaho and Washington.

ILLUSTRATION: Bull. Torrey Club 20: pl. 93.

6. *SAELANIA* Lindb. Utkast 35. 1878.

Plants caespitose. Stems branching by subapical innovations, in section bluntly triangular. Leaves linear-lanceolate, serrate, glaucous, with a white filamentous or granular dorsal surface, costate to the apex; perichaetial leaves longer. Autoicous. Seta exserted, erect. Calyptra cucullate. Capsule ovoid-cylindric, erect, smooth or slightly furrowed when dry; lid conic annulus single; peristome single, with a short basal membrane; teeth 16, bifid, nodose, papillose. Spores small, papillose.

Type species, *Trichostomum glaucescens* Hedw.

1. *Saelania glaucescens* (Hedw.) Broth. in E. & P.Nat. Pfl. 1³: 300. 1901.? *Bryum caesium* Vill. Hist. Pl. Dauph. 3: 879. pl. 54. 1789.*Trichostomum glaucescens* Hedw. Descr. 3: 91. 1792.*Leptotrichum glaucescens* Hampe; Schimp. Syn. 146. 1860.*Ditrichum glaucescens* Hampe, Flora 50: 182. 1867.*Saelania caesia* Lindb. Utkast 35. 1878.

Plants caespitose, glaucous-green; stems 1-2 cm. high, branching fastigiately, with numerous slender, erect branches, naked and radiculose below, leafy above: leaves lanceolate, acute or acuminate, 1-1.5 mm. long; costa stout, yellow, smooth or slightly rough on the back at the apex; cross-section almost terete, with 2-4 guide-cells, a well developed stereid-band below, a smaller one above and differentiated dorsal cells, those of the blade with thick convex walls; margins slightly revolute below, serrate above, with a few distant, appressed teeth; cells oblong or square, not much elongate at base, occasionally double on the margins; perichaetium not sheathing, its leaves 1.5-2 mm. long, narrowly lanceolate-acuminate, almost subulate; costa often excurrent; basal cells longer and clearer; margins revolute, irregularly toothed. Autoicous: antheridia terminal on separate branches: inner perigonial leaves short and blunt, the outer ones longer, lanceolate: seta 5-10 mm. long, erect, twisted: calyptra cucullate: capsule erect, symmetric, slightly sulcate when dry, 1.5-2 mm. long, ovoid-cylindric, broadest at base; neck short, stomatose; mouth narrow; lid conic, beaked; annulus of 2-3 rows of cells, dehiscent; peristome red; basal membrane short; teeth erect or slightly twisted when dry, bifid, more or less united at the joints, slender and papillose: spores papillose, 14-18 μ in diameter, maturing from May to August.

TYPE LOCALITY: Sweden.

DISTRIBUTION: Greenland; Hudson's Bay to British Columbia, Ounalaska, and Behring Sea; on rocky limestone cliffs, not common, New England, New York, and New Jersey; Minnesota to the Rocky Mountains; also in Europe and Asia.

ILLUSTRATIONS: Hedw. Descr. 3: pl. 37, B; B.S.G. Bryol. Eur. pl. 184.

EXSICC.: Drummond, Musci Am. 117; Sull. & Lesq. Musci Bor. Am. 156; Aust. Musci App. 121; Macoun, Can. Musci 68; Holz. Musci Acroc. Bor. Am. 13.



Family 4. BRYOXIPHIACEAE

By ELIZABETH GERTRUDE BRITTON

Plants gregarious, erect or pendent from a thickened base. Stems rigid, simple or branching by subapical innovations, oval in cross-section with a central strand. Leaves distichous, crowded, erect-appressed, imbricate; base clasping; apex mucronate or subulate; costa stout, broad or with a dorsal wing. Perichaetial leaves longer, subulate. Dioicous. Seta short, usually recurved. Calyptra cucullate. Capsules ovoid, apiculate; lid small, conic-apiculate; annulus and peristome lacking.

1. BRYOXIPHIMUM Mitt. Jour. Linn. Soc. 12: 580. 1869.

Plants gregarious, pendent; stems simple or branched, straight or flexuous, bulbous and radiculose at the base. Leaves erect, distichous, equitant, conduplicate, with a stout, keeled, excurrent costa; perichaetial leaves elongate into a long flexuose awn. Dioicous. Seta short, recurved. Calyptra cucullate, terminating in a long awn. Capsule pendent, small, ovoid; columella persistent, attached to the lid; peristome and annulus lacking. Spores smooth.

Type species, *Phyllogonium norvegicum* Brid.

Leaves obtuse or retuse, entire.

Leaves acute or mucronate, serrate.

1. *B. norvegicum*.

2. *B. mexicanum*.

1. *Bryoxiphium norvegicum* (Brid.) Mitt. Jour. Linn. Soc. 12: 580. 1869.

Phyllogonium norvegicum Brid. Bryol. Univ. 2: 674. 1827.

Fissidens imbricatus Desv.; Brid. Bryol. Univ. 2: 674. 1827.

Eustichium norvegicum B.S.G. Bryol. Eur. (42:) Eust. 3. 1849.

Bryoxiphium imbricatum Lindb. Musci Scand. 44. 1879.

Plants forming dense, glossy masses of a light-green color, pendent on wet sandstone rocks; stems 2-4 cm. long, simple or branching by innovations near the tip, bulbous and rooting at the base; leaves 1-2 mm. long, imbricate, distichous, smaller below, enlarging gradually upward, with a prominent costa, keeled above and percurrent or excurrent into a serrulate cusp; apex obtuse; margins entire; cells elongate, hyaline below, quadrate-hexagonal above; perichaetial leaves 3-5 mm. long, lanceolate-subulate, the costa excurrent into a long serrulate twisted point. Dioicous; antheridia terminal, few, without paraphyses; seta 2 mm. long, recurved; calyptra cucullate, the awn persistent, 0.75 mm. long; capsule pendent, 1-1.5 mm. long, pale, obovoid, with a conic apiculate lid, persistent on the exerted columella; neck short, stomatose; spores 15-20 μ in diameter, smooth, maturing in July. Usually sterile.

TYPE LOCALITY: Iceland (not Norway!).

DISTRIBUTION: Pennsylvania, Ohio, Kentucky, Indiana, Wisconsin, Minnesota, and Washington; very rare.

ILLUSTRATIONS: Mem. Am. Acad. II. 3: pl. 1; B.S.G. Bryol. Eur. pl. 195; Bull. Torrey Club 10: 100.

EXSICC.: Sull. Musci Allegh. 188; Sull. & Lesq. Musci Bor. Am. 109; ed. 2. 163; Ren. & Card. Musci Am. Sept. Exs. 21, B, C; Holz. Musci Acroc. Bor. Am. 10.

2. *Bryoxiphium mexicanum* Besch. Jour. de Bot. 6: 180. 1892.

Bryoxiphium norvegicum Mitt. Jour. Linn. Soc. 12: 580, in part. 1869.

Eustichium norvegicum Besch. Mém. Soc. Sci. Nat. Cherbourg 16: 173. 1872. Not *E. norvegicum* B.S.G. 1849.

Plants gregarious, pale-green, glossy, pendent from vertical faces of cliffs; stems 3-4 cm. long, bulbous and rooting at the base, simple, or irregularly branching by subapical inno-

variations: leaves distichous, imbricate, lanceolate, 2-3 mm. long, the apex acute, cuspidate or mucronate, serrate; costa ending below the apex, dorsally winged above; perichaetial leaves 5-7 mm. long, with a slender subulate sinuous awn. Dioicous: antheridia few, terminal: seta recurved, 3-5 mm. long: calyptra 1 mm. long, pale, cucullate: capsule pendent, ovoid, 1 mm. long, with a short stomatose neck; lid small, obliquely beaked, bordered with red cells; mouth also bordered with denser smaller irregular cells; walls thickened, brown when old, of irregular, hexagonal, thick-walled cells: spores 18-21 μ in diameter, finely granular, not quite smooth, maturing in June and July.

TYPE LOCALITY: Valley of Mexico City, Mexico.

DISTRIBUTION: Federal District; Orizaba, Vera Cruz.

EXSICC.: Pringle, Musci Mex. 10827.

Family 5. SELIGERiaceae

By ELIZABETH GERTRUDE BRITTON

Small gregarious or cespitose plants, growing on limestone or sandstone rocks. Stems short, simple or branching. Leaves lanceolate or subulate, costate, entire or serrulate, smooth, with alar cells differentiated only in *Blindia*; perichaetial leaves often larger with a longer subulate apex. Autoicous or dioicous. Seta exserted, erect or curved. Calyptra cucullate or lobed. Capsules ovoid or pyriform, the mouth often broad; lid rostrate; peristome lacking or single; teeth 16, without a median line, more or less perfect, truncate, split or perforate. Spores smooth or slightly roughened.

Plants very small, gregarious; alar cells not enlarged.

Capsule smooth; teeth, if present, smooth; annulus none.

Capsule striate; teeth papillose; annulus present.

Plants taller, cespitose; alar cells enlarged; capsule smooth; teeth smooth; annulus none.

1. SELIGERIA.

2. BRACHYDONTIUM.

3. BLINDIA.

1. SELIGERIA B.S.G. Bryol. Eur. (33-36 :) Selig. 1. 1846.

Plants very small, gregarious, growing on limestone and sandstone rocks. Stems simple or with short basal branches, rarely with longer sterile innovations, in cross-section 3-angled, with a central strand. Leaves 3-5-ranked, the lower ones small, the upper longer, crowded, lanceolate or subulate from a broader, clasping base; costa of uniform cells, often thick and excurrent; lower cells thin-walled, the upper ones thickened; perichaetial leaves often longer, mostly not much differentiated. Monoicous, rarely dioicous. Antheridia in basal or subapical buds. Seta short, exserted, erect or curved. Calyptra cucullate. Capsule ovoid or pyriform, minute; neck usually distinct, stomatose; lid rostrate; annulus none; peristome none or simple; teeth 16, erect or recurved when dry, mostly entire and smooth, or with thick joints. Spores smooth or rough.

Type species, *Azelia pusilla* Ehrh.

Peristome none. (ANODUS.)

Peristome present. (EUSELIGERIA.)

Seta straight or slightly curved; capsules broad-mouthed.

Seta 1 mm. high or less; leaves not 3-ranked, erect or secund.

Leaves serrulate, the awn slender, long and tapering.

Leaves entire, the awn thick, short and abrupt.

Seta 3-10 mm. high, branching; leaves 3-ranked, erect, appressed, or spreading.

Neck short; stomata perfect, basal.

Neck none; stomata imperfect, median.

Seta recurved when moist; capsules narrow-mouthed.

Leaves entire; costa filling the long smooth awn.

Leaves serrate; costa not filling the short papillose apex.

1. *S. Doniana*.

2. *S. pusilla*.

3. *S. calcarea*.

4. *S. trifaria*.

5. *S. tristichoides*.

6. *S. setacea*.

7. *S. campylopoda*.

1. *Seligeria Doniana* (Smith) C. Müll. Syn. 1 : 420. 1848.

Gymnostomum Donnianum Smith, Engl. Bot. pl. 1582. 1806.

Anodus Donianus B.S.G. Bryol. Eur. (33-36:) Anodus 3. 1846.

Seligeria Donnii Lindb. Oefv. Sv. Vet.-Akad. Förh. 21: 187. 1864.

Plants very small, 2-5 mm. high, gregarious; stems erect, rarely 1 mm. high, simple, or with basal branches; leaves crowded, straight, 1 mm. long, subulate from a broader, serrulate base, costa broad, excurrent, filling the awn or disappearing below the apex in the lower leaves; basal cells oblong; margins crenulate-serrulate; perichaetial leaves shorter, not subulate, broader and sheathing, serrate. Autoicous; antheridia in basal buds, without paraphyses. Seta 1-3 mm. long, exserted, erect. Calyptra cucullate; capsule minute, 0.5 mm. or less, ovoid.

pyriform, becoming hemispheric and broader when empty; neck short, stomatose; walls thickened, the cells oblong or hexagonal, irregular; mouth bordered by 4-5 rows of cells; lid conic, oblique, bordered; peristome none: spores smooth, 8-10 μ in diameter, maturing in summer.

TYPE LOCALITY: England.

DISTRIBUTION: In pockets and hollows of sandstone and limestone rocks, rare; Ontario; Maine; New York; New Jersey; Ohio; Minnesota to Alberta.

ILLUSTRATIONS: Engl. Bot. *pl.* 1582; B.S.G. Bryol. Eur. *pl.* 109.

EXSICC.: Drummond, Musci Am. 22; Sull. Musci Allegh. 142, in part.

2. *Seligeria pusilla* (Ehrh.) B.S.G. Bryol.

Eur. (33-36 :) Selig. 4. 1846.

Weisia pusilla Hedw. Descr. 2: 78. 1789.

Swartzia pusilla Ehrh.; Hedw. Descr. 2: 78, as synonym. 1789.

Plants minute, bright-green, glossy and gregarious: stems 1-2 mm. high, simple or branching and leafless at the base: leaves crowded, erect or secund, 1-2 mm. long, narrowly lanceolate, subulate; costa nearly filling the long, slender, entire awn; margins incurved; basal cells oblong, clear; perichaetial leaves erect, the base broader and clasping, 2-2.5 mm. long, the basal cells linear. Autoicous: antheridia in lateral buds, the bracts small, veinless: seta erect, 3-5 mm. long; calyptra small, cucullate: capsule ovoid-pyriform, 0.5-1 mm. long; lid obliquely rostrate; neck stomatose; mouth bordered by 5-6 rows of cells; walls thin, the cells very irregular; peristome red or brown, reflexed when dry, inserted below the mouth; teeth entire, smooth, with 6-8 thickened joints: spores minutely roughened, 10-14 μ in diameter, maturing in summer.

TYPE LOCALITY: Hanover, Germany.

DISTRIBUTION: On wet shady limestone cliffs, rare; Quebec; Ontario; Kelly's Island in Lake Erie; Minnesota to Missouri.

ILLUSTRATIONS: Hedw. Descr. 2: *pl.* 29, A; B.S.G. Bryol. Eur. *pl.* 110; Rab. Krypt.-Fl. 4: *f.* 146; Braithw. Brit. Moss-Fl. *pl.* 16, H.

EXSICC.: Drummond, So. Mosses 35; Macoun, Can. Musci 59.

3. *Seligeria calcarea* (Dicks.) B.S.G. Bryol. Eur.

(33-36 :) Selig. 4. 1846.

Bryum calcareum Dicks. Pl. Crypt. Brit. 2: 3. 1790.

Weisia calcarea Hedw. Sp. Musc. 66. 1801.

Plants small, gregarious; stems short, less than 1 mm. high, leafless below, branching by basal buds: leaves crowded at the apex, erect, short, less than 1 mm. long, ovate, abruptly subulate from a broad clear, clasping, sometimes toothed base; costa broadening into and forming the blunt, thick, subulate awn; basal cells clear, rectangular, the upper ones dense, square; perichaetial leaves erect, clasping, longer and broader, 0.5-1 mm. long. Autoicous: antheridia in basal buds, the bracts veinless: seta 2 mm. long, thick, erect, twisted: calyptra cucullate, 0.75 mm. long; capsule ovoid-pyriform, 0.5 mm. long; neck distinct; walls thickened, the cells irregular; stomata absent or imperfect and median; mouth broad, bordered by 3-4 rows of cells; lid conic-rostrate; peristome incurved or recurved, red-brown; teeth fragile, smooth, and thickened at the joints: spores 14-18 μ in diameter, slightly rough, maturing in summer.

TYPE LOCALITY: Newmarket Heath, England.

DISTRIBUTION: Very rare, on wet limestone rocks, near Columbus, Ohio; Ontario to Manitoba; also in Europe.

ILLUSTRATIONS: Dicks. Pl. Crypt. Brit. *pl.* 4, *f.* 3; Hedw. Sp. Musc. *pl.* 11; B.S.G. Bryol. Eur. *pl.* 110; Braithw. Brit. Moss-Fl. *pl.* 17, B.

EXSICC.: Drummond, Musci Am. 65; Sull. Musci Allegh. 142, in part.

4. *Seligeria trifaria* (Brid.) Lindb. Oefv. Sv. Vet.-Akad.

Förh. 20: 413. 1863.

Weisia trifaria Brid. Jour. Bot. Schrad. 1800¹: 283. 1801.

Weisia tristicha Brid. Musc. Recent. Suppl. 1: 116. 1806.

Seligeria tristicha B.S.G. Bryol. Eur. (33-36:) Selig. 5. 1846.

Plants 3-6 mm., rarely 1 cm. high, gregarious or cespitose; stems fragile, rigid, erect, with numerous simple sterile subapical branches, naked at the base; leaves three-ranked, erect-appressed, 1 mm. long or less, lanceolate-subulate, from a narrow, concave, entire base; costa thick, broad, excurrent into a very slender, rough awn; lower cells clear, oblong-linear, the upper ones quadrate, dense with thick projecting walls; perichaetial leaves 1.5 mm. long, clasping at the base, tapering into the awn. Autoicous: antheridia in lateral buds: seta 2-3 mm. long, erect, pale-yellow and twisted: calyptra cucullate: capsule small, 1 mm. long or less, ovoid-pyriform, erect, broadly turbinate when empty; neck nearly as long as the urn, stomatose, with lax, elongate cells; lid rostrate; upper walls dense, the cells irregular, much thickened; mouth bordered by 4-5 rows of transverse cells; peristome recurved, inserted at the mouth; teeth red, occasionally perforate: spores large, 24-32 μ in diameter, slightly roughened, maturing in summer.

TYPE LOCALITY: Salzburg, Austria.

DISTRIBUTION: On limestone rocks, Gaspé, Quebec; shaded ravines, Ohio; very rare; also in Europe and Asia.

ILLUSTRATIONS: B.S.G. Bryol. Eur. *pl. III*; Braithw. Brit. Moss-Fl. *pl. 16, K*.

EXSICC.: Sull. Musci Alleg. *142*, in part.

5. *Seligeria tristichoides* Kindb. Rev. Bryol. 23: 20. 1896.

Seligeria trifaria palula Lindb. Oefv. Sv. Vet.-Akad. Förh. 21: 189. 1864.

Seligeria tristicha laxa Holz. Bryologist 5: 9. 1902.

Seligeria tristichoides laxa Holz. Bryologist 5: 63. 1902.

Plants in bright-green cushions, mixed with lime; stems 3-5 mm. high, crowded and branching, with numerous short sterile, triquetrous innovations: leaves bright-green, spreading or reflexed, tristichous, 1-1.5 mm. long, lanceolate-subulate from a pale hyaline base; costa percurrent into a rough thick point, not quite filling the awn, ending in a short apical cell; lower cells linear, the upper cells shorter with thick projecting walls; perichaetial leaves longer, erect or spreading, the point scabrous and broader, almost reaching the base of the capsule. Autoicous: antheridia few, in clustered axillary or basal buds: seta erect, or slightly curved, 1-1.5 mm. long, stout: calyptra cucullate, 1 mm. long: capsule ovoid, becoming hemispheric when empty; lid rostrate, 0.5 mm. long; columella more or less persistent and exerted; mouth broad, bordered by darker denser cells; neck lacking; stomata imperfect, around the middle of the capsule; walls with thick irregular hexagonal cells, pustulose when dry; peristome red, inserted below the mouth; teeth incurved, smooth, occasionally perforate, with 10-12 narrow joints: spores yellow, minutely roughened, 18-24 μ in diameter, maturing in June.

TYPE LOCALITY: Northern Norway.

DISTRIBUTION: Cliff at Willoughby Lake, Vermont; also in France, on the slopes of the Pyrenees, and Norway.

ILLUSTRATION: Bryologist 5: 8. f. 2-5.

6. *Seligeria setacea* (Wulf.) Lindb. Oefv. Sv. Vet.-Akad.

Förh. 20: 413. 1863.

Bryum setaceum Wulf. in Jacq. Misc. Austr. 2: 96. 1778.

Grimmia recurvata Hedw. Descr. 1: 102. 1787.

Seligeria recurvata B.S.G. Bryol. Eur. (33-36) Selig. 6. 1846.

Plants gregarious in small clusters; stems short, 3-5 mm. high, branched and leafless at the base; leaves erect, or slightly recurved, 1-2 mm. long, subulate from an ovate clasping base, entire; costa thick, excurrent into a slender subulate smooth awn; lower cells thin and clear, the upper ones with thick walls; perichaetial leaves 2 mm. long, the awn more than one-half the length of the leaf, rarely toothed at the apex. Autoicous: antheridia in lateral buds: seta recurved when moist, becoming erect when dry, 3-5 mm. long: calyptra large, cucullate: capsule ovoid-pyriform, becoming narrower and cylindric when empty, 0.75-1 mm.; neck short, stomatose, the cells square; lid long-beaked; mouth narrow, bordered by 4-5 rows of transverse cells; walls of very large, lax, irregularly thickened cells; peristome deeply inserted, red brown; teeth blunt or split, with thickened joints: spores small, 8-10 μ in diameter, brown, slightly roughened, maturing in spring and summer.

TYPE LOCALITY: Klagenfurt, Carinthia, Austria.

DISTRIBUTION: On moist shaded, sandstone rocks, in hilly and mountainous regions of New York, New Jersey, and Pennsylvania; Mt. Rainier, Washington; also in Europe and Asia.

ILLUSTRATIONS: Dill. Hist. Musc. *pl.* 49, *f.* 53; Jacq. Misc. Austr. *pl.* 12; Hedw. Descr. 1: *pl.* 38; B.S.G. Bryol. Eur. *pl.* 112; Braithw. Brit. Moss-Fl. *pl.* 17, *C.*

EXSICC.: Aust. Musci App. 110.

7. *Seligeria campylopoda* Kindb.; Macoun, Cat. Can.

Pl. 6: 41. 1892.

Seligeria recurvata arcuata Lesq. & James, Man. 97. 1884.

Seligeria subcampylopoda Kindb.; Broth. in E. & P. Nat. Pfl. 1³: 1176, *nomen nudum*. 1909.

Plants gregarious, small, 1-3 mm. high; stems short, usually simple and unbranched; leaves crowded, 1-1.5 mm. long, lanceolate-acuminate, not subulate, erect, spreading or recurved; costa stout, ending below the apex and not filling the point, subpapillose on the back, above; margins entire or sometimes clearly serrate and revolute; basal cells oblong, the marginal ones linear, clear, the upper rounded or square with thick projecting walls; perichaetial leaves erect, rarely subulate with percurrent costa, the base longer and broader. Dioicous, autoicous, or synoicous (?); seta recurved when moist, usually 2-3 mm., rarely 4-5 mm. long; calyptra cucullate; capsule small, 0.5-1 mm. long, ovoid or pyriform, not wide-mouthed; neck short, stomatose; lid with a long, sharp beak; walls thin, of irregular oblong cells; mouth bordered by 2-3 rows of cells; peristome bright-red or brown, deeply inserted; teeth with 12-14 thick joints, perforate or split above; spores small, 8-10 μ in diameter, slightly roughened, maturing in September and October.

TYPE LOCALITY: Owen Sound, Ontario.

DISTRIBUTION: On damp and shaded limestone rocks and boulders, Newfoundland; Ontario; Niagara Falls; New York; Ohio; Montana; British Columbia.

ILLUSTRATION: Bull. N. Y. Bot. Gard. 2: *pl.* 35.

EXSICC.: Drummond, Musci Am. 66 (as *Weisia Seligeri*); Sull. Musci Allegh. 141; Macoun, Can. Musci 60, in part.

2. *BRACHYDONTIUM* Fürnr. Flora 10²: Beil. 37. 1827.

Brachyodon Fürnr. Flora 10²: Beil. 112. 1827.

Brachyodus Nees & Hornsch. Bryol. Germ. 2²: 3. 1831.

Plants minute, gregarious and abundantly fertile. Stems simple or fasciculately branching by basal innovations. Leaves crowded, short, subulate from a broader clasping base, entire; costa smooth. Autoicous. Antheridia in small basal buds with short ecostate bracts. Seta short, terminal, erect. Calyptra lobed. Capsule minute, ovoid, striate, becoming brown and sulcate when old; lid large, beaked; annulus large; peristome single, papillose; teeth 16, short, truncate, more or less perforate and bifid at the apex. Spores small, smooth.

Type species, *Gymnostomum trichodes* Weber f.

1. *Brachydontium trichodes* (Weber f.) Bruch; Paris, Index Bryol. ed. 2. 1: 124. 1904.

Gymnostomum trichodes Weber f.; Weber & Mohr, Arch. Syst. Nat. 1: 124. 1804.

Grimmia trichodes Smith, Engl. Bot. *pl.* 2563. 1813.

Weisia trichodes Hook. & Tayl. Musc. Brit. 45. 1818.

Brachyodus trichodes Nees & Hornsch. Bryol. Germ. 2²: 5. 1831.

Plants small, 3-5 mm. high, yellow or dark-green; stems short, 1 mm. long, densely leafy; leaves imbricate, erect or slightly secund or twisted when dry, 1-1.5 mm. long, subulate from a broader clasping base; costa abruptly excurrent into a slender, entire or obscurely serrulate apex; basal cells large, clear, the upper ones denser, obscure. Autoicous; antheridia in small basal buds: seta 2-3 mm. long, yellow, erect, twisted; calyptra lobed: capsule minute, 1 mm. long including the beak of the lid; annulus large, falling in fragments; peristome white; teeth short, imperfect, composed of 2-5 joints, papillose on both sides, entire or perforate: spores 8-10 μ in diameter, maturing in spring.

TYPE LOCALITY: Harz Mountains, Germany.

DISTRIBUTION: Rare on trap dykes in Tuckerman's Ravine, Mount Washington, New Hampshire; more common in various parts of Europe, in mountains.

ILLUSTRATIONS: Weber & Mohr, Arch. Syst. Nat. 1. *pl.* 4; Schwaegr. Suppl. *pl.* 12 (as *Anoetangium*); Engl. Bot. *pl.* 2563; B.S.G. Bryol. Eur. *pl.* 115.

3. BLINDIA B.S.G. Bryol. Eur. (33-36 :) Blindia 1. 1846.

Plants tall, slender, caespitose. Stems branching repeatedly and dichotomously, naked and decumbent at the base, with a central strand. Leaves secund, glossy, lanceolate-subulate from a concave clasping base, the basal angles auricled; costa percurrent, of uniform cells in 3-5 layers. Dioicous, or autoicous in some exotic species. Seta exserted, straight or curved. Calyptra cucullate. Capsules globose-pyriform or turbinate; lid rostrate; peristome single, red; teeth 16, entire, smooth, perforate or split; annulus none. Spores smooth.

Type species, *Bryum acutum* Huds.

1. *Blindia acuta* (Huds.) B.S.G. Bryol. Eur. (33-36 :) Blindia 3. 1846.

Bryum acutum Huds. Fl. Angl. ed. 2. 484. 1778.

Weisia acuta Hedw. Descr. 3: 85. 1792.

Blindia acuta flexipes Ren. & Card. Rev. Bryol. 19: 79. 1892.

Blindia flexipes Kindb. Eur. & N. Am. Bryin. 214. 1897.

Plants caespitose, 2-10 cm. high, light-green, brown, or black; stems slender, simple or branching by repeated subapical innovations: leaves crowded, glossy, erect, spreading or secund, 2-3 mm. long, lanceolate-subulate, concave, with entire incurved margins; costa broadening upward and filling all the subulate awn, toothed at the apex; alar cells square, thick-walled, forming a large brown auricle; basal cells linear, their walls thick; perichaetial leaves erect, broader and clasping at the base, abruptly mucronate. Dioicous: antheridia terminal, becoming lateral by innovations: seta 3-8 mm. long, straight or curved: calyptra cucullate: capsule small, 1-1.5 mm. long, pyriform with a short stomatose neck; lid conic-rostrate; peristome bright-red; teeth lanceolate, smooth, entire or perforate and split at the apex; annulus none; mouth bordered by 4-5 rows of narrower darker cells; walls thickened, the cells irregular: spores smooth, 10-18 μ in diameter, maturing in summer.

TYPE LOCALITY: Mountains of Wales.

DISTRIBUTION: On wet rocks and cliffs in mountains, Greenland; Labrador to Alaska, and southward to New York, Michigan, Minnesota, and Oregon; also in Europe and Asia.

ILLUSTRATIONS: Dill. Hist. Musc. pl. 47, f. 34; Hedw. Descr. 3: pl. 35; B.S.G. Bryol. Eur. pl. 114; Rab. Krypt.-Fl. 4: f. 149.

EXSICC.: Drummond, Musci Am. 72; Breutel, Musci Frond. Exs. 36; Sull. & Lesq. Musci Bor. Am. 113; Aust. Musci App. Suppl. 487; Macoun, Can. Musci 61; Ren. & Card. Musci Am. Sept. Exs. 362; Holz. Musci Acroc. Bor. Am. 11, 179.

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